MINING WORLD

Page 34

MAY 1955

VOL. 17 No. 6

50 cents a copy
In sterling 3s 6d

THIS MODEL 40H EIMCO LOADER used by Harmony Gold Mining Company, helped establish an all time tunneling record. Dependable, safe Eimcos are the preferred standard equipment in all tunnel jobs.

EIMCO

THE EIMCO CORPORATION
Salt Lake City, Utah, U.S.A.
Export Office: Eimco Bldg., 52 South St., New York City

1–Plant Offices
2–Electrical Shop
3–Material Storage
4–Assembly–Testing–Shipping
5–Machine Shop
6–Weld Shop
7–Stock Room
8–Tool Room
9–Boiler Plant & Research
10–Grinding Shop
11–Pattern Shop

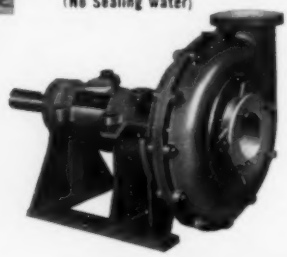
A-S-H plant at Hamburg, Pa., in the "Pennsylvania Dutch" country, where Hydroseal and Centriseal Pumps are made by highly-skilled workers.

Background of better pumping

INTERCHANGEABLE

HYDROSEAL Slurry Pump
(Sealing water)

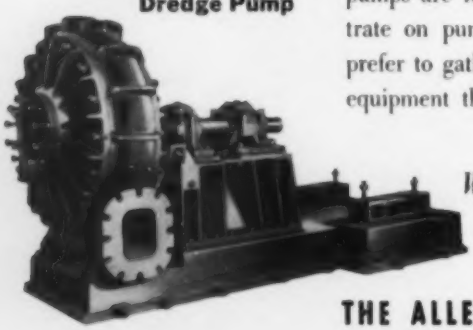
CENTRISEAL Slurry Pump
(No Sealing water)



HYDROSEAL
Sand Pump

Looking from Assembly, Testing and Shipping section into the Machining area of Hamburg plant.

HYDROSEAL
Dredge Pump



Coordination of engineering and manufacture is a basic factor of the extraordinary effectiveness with which A-S-H pumps solve abrasives-pumping problems. When situations call for variations in design, new pumps are forthcoming with dispatch, for we concentrate on pumps – only pumps. As to accessories, we prefer to gather together the motor, drive and control equipment that is best for the particular installation.

Sales, Service & Engineering staffs plan installations and keep continuous performance records at Wynnewood, Pa.

Write us about your pumping problem.

THE ALLEN-SHERMAN-HOFF PUMP CO.
Dept. J–259 E. Lancaster Ave., Wynnewood, Pa.
Representatives throughout the World

HYDROSEAL *and CENTRISEAL*
SAND, SLURRY & DREDGE PUMPS
MAXIMIX RUBBER PROTECTED

Salt Lake City, Utah, U.S.A.
Export Office: Simco Bldg., 52 South St., New York City

"Eucs" pace production at Nelson Crushed Stone Ltd.

Powered by a 300 h.p. engine with 10-speed transmission, this 22-ton Rear-Dump Euclid has a top travel speed of 32 m.p.h. with full payload . . . one of the reasons "Eucs" haul more tonnage at lower cost.

The limestone quarry and plant of Nelson Crushed Stone Ltd., north of Hamilton, Ontario, is one of Canada's newest and most modern operations. This stone plant, with a capacity of more than 500 tons per hour, was designed for maximum efficiency and flexibility—it can produce virtually any size stone.

Three 22-ton Rear-Dump "Eucs", loaded by a 2½ yd. shovel, haul dolomite to a primary crusher about ¼ mile from the face. Equipped with quarry bodies having flared sides that facilitate loading and minimize spillage, these "Eucs" have 300 h.p. engines and 10 speed transmissions.

Rear-Dump Euclids are standard off-the-highway hauling units in mines and quarries because of their ability to stay on the job year after year with low maintenance cost. For a production and cost estimate on your operation get in touch with your Euclid dealer . . . there's no cost or obligation.

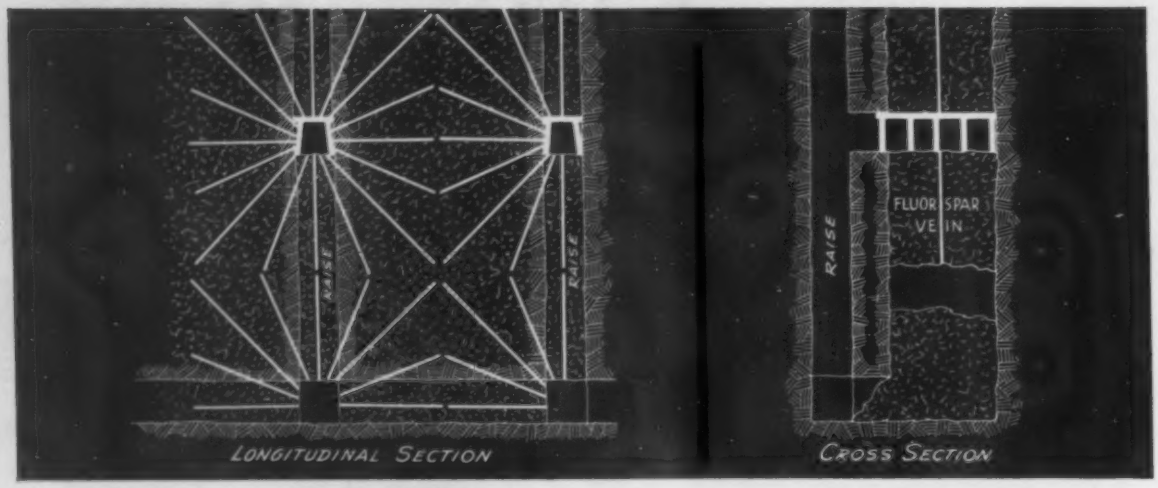
Rugged construction of the body and frame enables "Eucs" to withstand the impact of loading rock and other heavy excavation with large loading equipment. Here a 2½ yd. shovel loads 22 tons of dolomite for haul to the primary crusher.

EUCLID DIVISION GENERAL MOTORS CORPORATION, Cleveland 17, Ohio

Euclid Equipment

FOR MOVING EARTH, ROCK, COAL AND ORE

GENERAL MOTORS

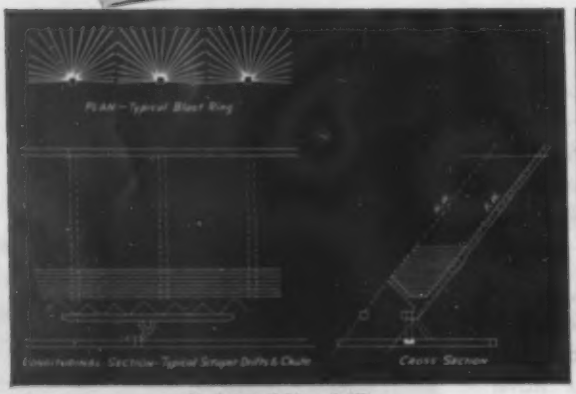


Vertical Ring Drilling

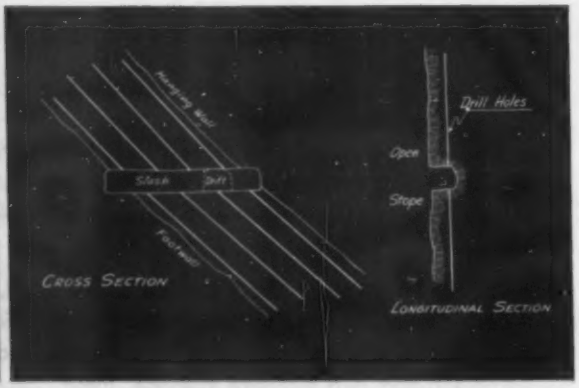
never before

. . . A BOOK LIKE THIS!

New deep hole drilling applications point the way to cost-saving underground mining methods with Gardner-Denver equipment engineered for deep hole percussion drilling.



Horizontal Ring Drilling



Boundary Pillar Recovery

Send for your copy today! 24 pages! No cost or obligation.

GARDNER-DENVER

THE QUALITY LEADER IN COMPRESSORS, PUMPS AND ROCK DRILLS FOR CONSTRUCTION, MINING, PETROLEUM AND GENERAL INDUSTRY

Gardner-Denver Company, Quincy, Illinois

Export Division: 233 Broadway, New York 7, N. Y., U. S. A.

Mining World

Including the Export Edition **WORLD MINING**

Published monthly except in April when publication is semi-monthly

VOLUME 17 **MAY 1955** No. 6

MINING WORLD

	Page
Drifts and Crosscuts	29
Capitol Concentrates	31
O'okiep Copper Company: Introduction	34
Geology and Geophysics Add to Ore Reserves by D. De N. Wild	36
O'okiep's Power Plant and Mine Shops by R. C. Mohler	55
How Acid and Lime are Made at O'okiep	56
U. S. Personalities in the News	61
Metal and Mineral Prices	100
Index of Advertisers	110

WORLD MINING

Mining Method: Longhole Blasting from Sublevels by E. P. Swanson, J. H. Smyth and P. C. Cain	39
Concentrating Ores by Flotation, HMS and Leaching by F. J. Martin, D. P. Britts, and C. H. DeBeer	45
Recovering Tungsten from Low-Grade Ore by D. R. Richardson	50
First Modern Copper Smelter at Namaqualand, South Africa	52
Newsmakers in International Mining	63
Fission Facts	65
International Panorama	66
International News	67
Production Equipment Preview	84

PUBLISHING OFFICE
Emmett St., Bristol, Conn.

EDITORIAL AND EXECUTIVE OFFICES
121 Second St., San Francisco 5, Calif., GArfield 1-5887

General Manager, San Francisco M. F. Holsinger
Editor ..... George O. Argall, Jr.
Field Editor ..... Stanley Dayton
News Editor ..... J. M. Taylor
Assistant News Editor ..... J. Wolfe
Product Editor ..... B. A. McCurry
Production Manager .... J. A. Cheesman
Dist. Mgr., New York .... A. E. Roberts
Dist. Mgr., Chicago ..... R. N. Crosby
Assoc. Ed., Van. ..... Charles L. Shaw

BRANCH OFFICES

New York 17—370 Lexington Ave., Murray Hill 3-9295. Chicago 26—1791 Howard, Rogers Park 4-3420. Vancouver, B.C.—402 Pender St. West, MArine 7287.

PUBLISHED BY

American Trade Journals, Inc.
Miller Freeman, President — W. B. Freeman, Vice President
L. K. Smith, Vice President — Miller Freeman, Jr., Sec.-Treas.

STAFF CORRESPONDENTS

Africa: Accra, Gold Coast; Costermansville, Belgian Congo; Johannesburg, Union of South Africa; and Kitwe, Northern Rhodesia. **Asia:** Ankara, Turkey; Benares, India; Kuala Lumpur, Federated Malay States; and Tokyo, Japan. **Europe:** Frankfurt, West Germany; Helsinki, Finland; London, England; Madrid, Spain; Vienna, Austria; Paris, France; Redruth, Cornwall; Rome, Italy; Stockholm, Sweden; The Hague, Netherlands; and Trondheim, Norway. **North and Central America:** Mexico City, Mexico; San Jose, Costa Rica; and Vancouver, British Columbia. **Oceania:** Port Kembla, (N.S.W.) Australia. **South America:** Bernal, Argentina; La Paz, Bolivia; Lima, Peru; and Sao Paulo, Brazil.

Not responsible for unsolicited manuscripts.

Copyright 1955 by American Trade Journals, Inc.

Contents may not be reproduced without permission

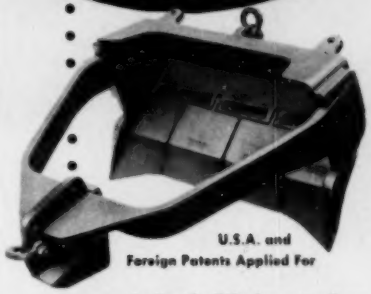
Mining World Subscription Rates

U. S. North, South and Central America	$3.00
Other Countries	$4.00
Single Copies	$ .50
Directory Number	$2.00

WORLD MINING is published the 26th of each month as a regular department of MINING WORLD and is also circulated as a separate publication on a carefully controlled free basis to a selected list of management and supervisory personnel associated with active mining enterprises throughout the world.

MILLER FREEMAN PUBLICATIONS

Pacific "SLUSHMASTER" SCRAPERS Move More Muck at less cost



U.S.A. and Foreign Patents Applied For

1. Pacific "Slushmasters" are standard equipment with many leading mining companies.
2. They stand up under the toughest service.
3. They help you move more muck at less cost.
4. Our very best advertising is provided by satisfied customers. Write us for names of those in your area.

TEN SIZES

MODEL	SIZE	WEIGHT
2A	26"	398#
2A	30"	485#
2A	34"	515#
AB	36"	744#
AB	42"	812#
AB	48"	951#
2B	36"	1280#
2B	42"	1395#
2B	48"	1520#
2C	60"	2360#

Let us send you copies of New Bulletins No. 253 and No. 254 which give specifications and operating features of Pacific "Slushmaster" Scrapers; also name of representative in your area.

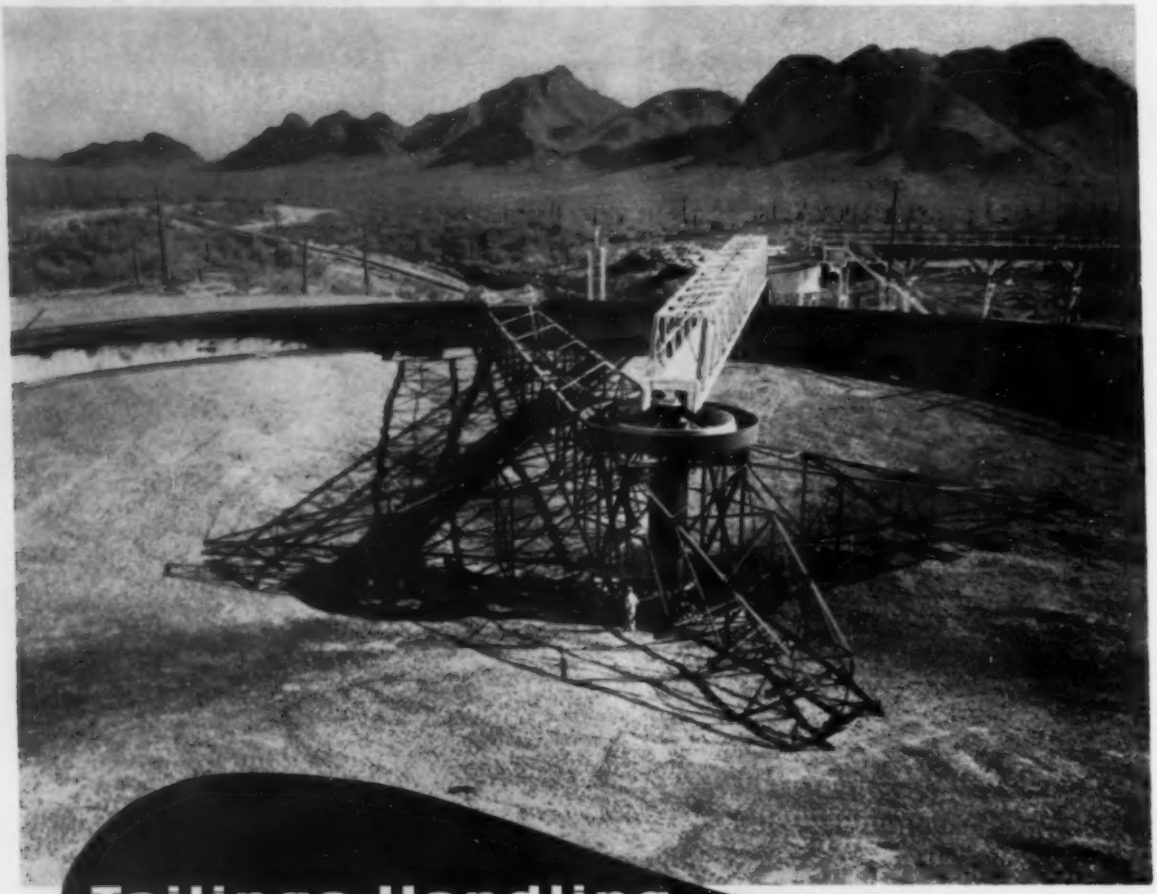
Use Pacific Sheave Blocks, Sheave Anchors, "Round-The-Corner" Sheave Blocks, Jaw Crushers, Bit Knockers and Pacific Wearing Parts.

A

ALLOY STEEL & METALS CO.

1848 E. 55th St., Los Angeles 58, Calif.
Mailing Address: Box 58323 Vernon Sta.
Los Angeles 58, Calif.

MINING WORLD, May, 1955. Volume 17, No. 6. Published monthly, except April, when publication is semi-monthly at Emmett St., Bristol, Conn. Executive, advertising and editorial offices, 121 Second St., San Francisco 5, California. Subscription in United States, North, Central and South America, $3.00 per year; other countries, $4.00 per year. Entered as second class matter Oct. 10, 1951 at the Post Office at Bristol, Conn., under the Act of March 3, 1879. Postmaster: please send notice 3579 to MINING WORLD, 121 Second St., San Francisco 5, Calif.



Tailings Handling Made Easy

Closeup of 275 ft. dia. Dorr Thickener during final stages of construction. Part of Hydroseparator is visible behind walkway.

7450 TPD of copper tailings can be a big headache without proper disposal facilities. At a new Concentrator in Arizona the proven Dorr Hydroseparator-Thickener team is taking shock loads and variable feed characteristics in stride.

The giant Thickener — 275 ft. in diameter — dominates the picture. But equally important to successful operation is the 30 ft. diameter Dorr Hydroseparator. By scalping out oversize material ahead of the Thickener, the Hydroseparator boosts thickening capacity and cuts water losses in the underflow.

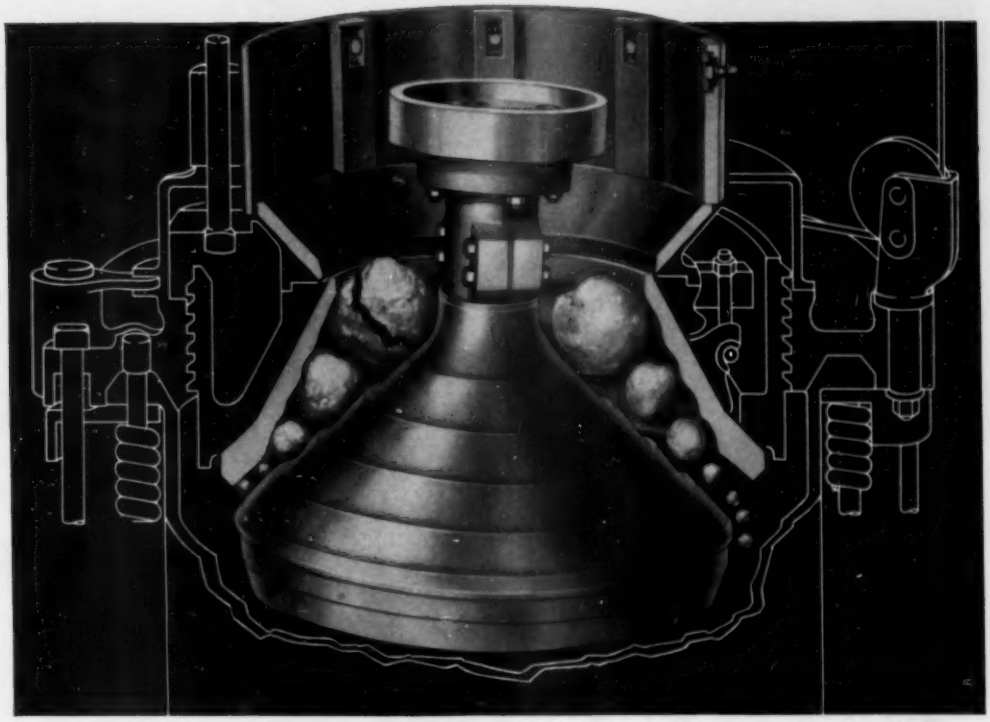
We'd like to tell you more about Dorr-Oliver's ability to provide the correct solution to tailings handling problems. Just drop a note to Dorr-Oliver Incorporated, Stamford, Conn. or in Canada, 26 St. Clair Ave. East, Toronto 5.

DORR-OLIVER
INCORPORATED
WORLD-WIDE RESEARCH · ENGINEERING · EQUIPMENT
STAMFORD · CONNECTICUT · U.S.A.

AMSCO® CRUSHER PARTS

"give" a little to

TAKE MORE PUNISHMENT



Amsco crusher parts are made of the toughest steel known—manganese steel. Typical of the Amsco line are the mantle and bowl liner in this sketch of a Symons® Cone Crusher. Symons is a registered trademark of Nordberg Manufacturing Company.

Under the violent crushing forces of impact, abrasion and pressure, the surface of Amsco manganese steel crusher parts work-hardens to as high as 500 Brinell. Yet beneath the working surface, the metal remains strong and ductile . . . able to *give* slightly under crushing forces . . . developing hardness as a new working surface is exposed by wear. That's why manganese steel crusher parts last so long, enduring severe abuse and resisting cracking or chipping even when worn thin.

Amsco makes manganese steel crusher parts for most manufacturers of crushing, grinding and pulverizing equipment. Buy your replacement parts from your crusher manufacturer to be sure of getting Amsco manganese steel.

Amsco also produces other alloy steels with maximum wear resistance under particular service conditions.

AMERICAN Brake Shoe COMPANY

AMERICAN MANGANESE STEEL DIVISION

Chicago Heights, Ill.

at O'Okiep Copper, too . . .
it's MARCY MILLS

Like so many other successful mining companies the O'Okiep Copper Co., Ltd. selected Marcy* Mills for low-cost-per-ton output and efficient, dependable mechanical operation.

● O'Okiep Copper Co., Ltd. exterior and the grinding section which includes 4—8' x 8' Marcy Grate Discharge Ball Mills and 2—4' x 8' Marcy Open End Rod Mills.

Why the Marcy principle of grinding...

"rapid change of mill content is necessary for high efficiency"...

gives greater output with lower KWH per ton

The "rapid change of mill content" is accomplished by use of the Marcy full grate discharge on ball mills and the open end feature on Marcy rod mills. This results in a low pulp line which provides an active, effective grinding mass to act on particle size reduction only . . . there is no wasteful cushioning action by high pulp levels. There is a faster migration of fines than oversize particles, thus less overgrinding.

WRITE FOR NEW CATALOG 101A

The Mine & Smelter Supply Co.

*Marcy is a registered trademark.

DENVER 17, COLORADO

OFFICES IN SALT LAKE CITY, EL PASO, 1775 BROADWAY, N. Y. C.

REPRESENTATIVES IN FOREIGN COUNTRIES

You Get Your Round in Faster

...and lower your drilling costs with a CLEVELAND Air Leg and Drill Combination

Cleveland Air Legs and Drills have these important essentials — easier handling, higher drilling speed, and sturdy dependability — that enable your miners to increase the footage they can drill per man-shift.

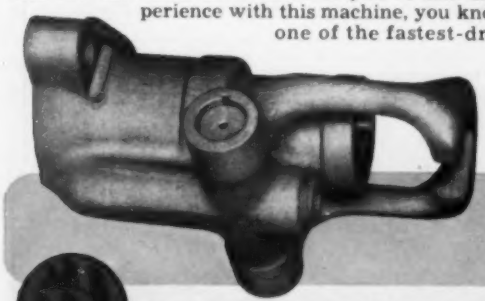
Here's why Cleveland Air Legs and Drills are easier to handle — Only Cleveland gives you an air leg and drill with a built-in 11-position feed control. It eliminates a third hose and cumbersome "Y" connections, reducing the weight a miner has to handle. No feed-control bleed valve is required either so that the operator doesn't have to bleed off air continuously to maintain suitable feeding pressure. And a new, quick-opening steel puller makes steel changing easier and faster.

Here's why Cleveland Air Legs and Drills have higher drilling speed — First of all, the Cleveland Air Leg uses the Cleveland H-10 drill. If you've had any experience with this machine, you know it's one of the fastest-drilling sinker drills made today. Then you have the built-in feed control that provides 11 feeding positions from zero to full-line pressure — with an increase of 9 psi at each setting. It lets the operator adjust the feed so that the drill is always down on the collar of the shank for maximum drilling speed, regardless of varying rock conditions.

Here's why Cleveland Air Legs and Drills stay underground longer — The Cleveland H10 drill is a proved performer, not only in the matter of drilling speed but also in upkeep cost. It's built to take it. And the Cleveland Air Leg holds the drill in line with the hole — thus reducing front-end drill wear and practically eliminating rotation strains. Moreover, the new steel puller helps to reduce maintenance costs still further. It consists of only five parts — there's only one spring and one plunger, and it's lubricated from the inside to prevent wear and to wash out dirt.

Four types available — There are four types of Cleveland Air Legs having conventional or telescopic, 3-ft., 4-ft., or 5-ft. feeds. Some models will take any 35-lb., 45-lb., or 55-lb. drill. Write for bulletin RD-30 that describes the Cleveland Air Leg in detail—the Air Leg that can help you get your rounds in faster for lower costs.

RD-65



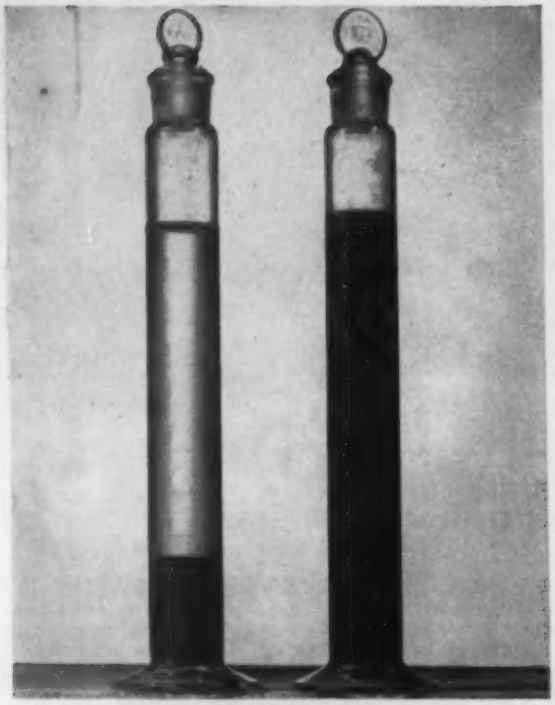
Close-up view of new Cleveland Steel Puller. It consists of only 5 parts and has one spring and one plunger. Lubricated from the inside to assure easy operation and to flush out dirt, this new steel puller is also easy to assemble and disassemble.

CLEVELAND ROCK DRILL DIVISION
Westinghouse Air Brake Co.

12500 BEREA ROAD
CLEVELAND 11, OHIO

DOW

Dow Announces
SEPARAN 2610
a superior flocculant



SEPARAN 2610 IMPROVES SETTLING RATE. The cylinder on the right shows untreated ore pulp containing 15% solids. The cylinder on the left containing the same pulp has been treated with .03 lb. SEPARAN 2610 per ton of dry solids. The picture was taken 30 seconds after addition of SEPARAN 2610 and agitation.

SEPARAN 2610 IMPROVES FILTRATION RATE. Filter above shows thin cake formed by untreated material. Filter below shows thick cake collected in the same length of time using SEPARAN 2610. This heavy, porous cake is much lower in moisture than the untreated material.

Under both laboratory and mill conditions, SEPARAN* 2610 has shown the following advantages over other flocculants:

- ★ Stepped up settling rate
- ★ Increased overhead clarity
- ★ Improved filtration rate
- ★ Decreased filter cake moisture
- ★ Increased recovery
- ★ And reduced cost—even as low as 1/10 of a cent per ton of solids.

Prove to yourself the advantages of SEPARAN 2610. Send this coupon in today for your trial sample and literature. THE DOW CHEMICAL COMPANY, Midland, Michigan. *Trademark

THE DOW CHEMICAL COMPANY
Dept. TS 788D, Midland, Michigan

Please send me further information and a trial sample of SEPARAN.

Name_____

Company_____

Address_____

City_____ State_____

you can depend on DOW CHEMICALS

DOW

Saves year in completing road to isolated copper mines

Deep in Northern Rhodesia's forest wilderness, near the Belgian Congo border, lies what geologists call the most important single copper-producing area in the world. From a 40 x 140 mile belt comes 250,000 to 300,000 tons of metal annually — 10% of the world's supply. Though mining has been done here since 1927, roads are still inadequate. To bring in necessary supplies, or to carry out the rich copper sulphide ores is expensive, difficult, and time-consuming.

Modern machines make the difference

Recently, the Government of Northern Rhodesia moved to change this situation. A 95-mile all-weather road was planned. Engineers estimated 30 months would complete the project.

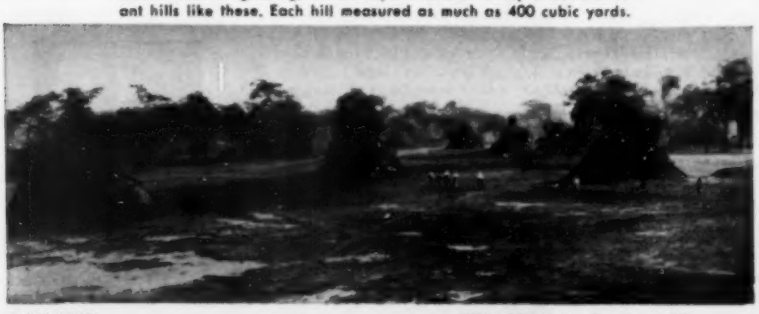
The contractors, Cramond Earth Movers Rhodesia Ltd., told the government they could better that schedule. In order to do it, they brought a fleet of 7 fast-operating, rubber-tired LeTourneau-Westinghouse machines to the job site at Choma. When photos were taken, these units were building 10 miles of road per month — instead of the scheduled 3 to 4 miles. Earth-moving was 60% ahead of schedule. Even allowing for lower output during the four-month rainy season, contractors and government officials believe the complete 95-mile route will be finished within 18 months.

Handle variety of work, faster

Two Tournatractors, three 14-yd. and two 7-yd. Tournapull-Scrapers have been working 72 hours a week, moving the 500,000 cu. yds. necessary to the job. After making major cuts and fills, Tournapulls spread and compact a laterite surface, finishing it to within one inch of grade line. Says Edward Austin, one of the officials of the company, "Accurate control of D Tournapulls has, on this job, cut grader work to an absolute minimum."

Moving subsoil for formation work, D Tournapulls have averaged a 2400 ft. load-haul-spread-and-return cycle every 6.3 minutes. Each unit has delivered 9 loads of approximately 5½ pay yards each per hour.

Before start of grading, D Tournapulls cleared away a number of ant hills like these. Each hill measured as much as 400 cubic yards.



Performance earns repeat orders

Cramond Earth Movers bought their first LeTourneau-Westinghouse machine, a second-hand Tournatractor, in 1950. Since then, they have purchased 6 more Tournatractors and Tournapulls. As a fleet, the 7 units have worked a total of 43,000 hours. Tires shown, each more than 4000 hours old, are still in usable condition. Mr. Austin reports, "Our Tournapull fleet has been increased three times, indicating our satisfaction. Downtime has been very low and production high."

Drive job-to-job

Another big advantage of rubber-tired units is their ability to drive job-to-job under their own power. These machines have traveled all over Central Africa to level marshalling yards and industrial sites, and to build sports fields and earth dams. Their big, low-pressure tires roll over paved highways, across country, or over railroad tracks without damage to surface or tires.

Let us help you

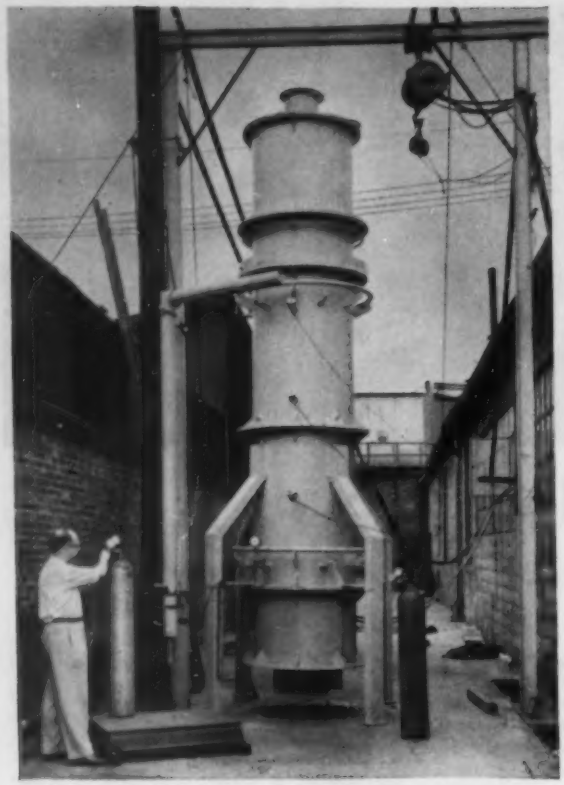
If you have similiar projects, it would pay you to find out how much LeTourneau-Westinghouse machines can save YOU in time and money. Call or write us for more information.

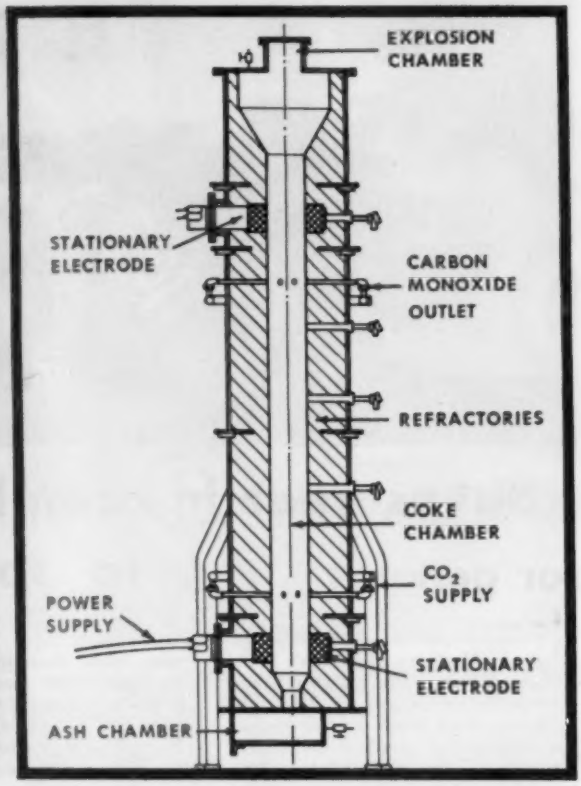
Tournapull—Trademark Reg. U.S. Pat. Off.
Tournatractor—Trademark TDP-683-H-b

LeTourneau-Westinghouse Company

PEORIA, ILLINOIS

A Subsidiary of Westinghouse Air Brake Company





CAN YOU USE SOMETHING LIKE THIS?

...for gaseous reactions using a conducting medium

This Lectromelt* Reactor was built for converting carbon dioxide to carbon monoxide continuously, on a pilot basis. The CO_2 is fed into the manifold near the bottom; it passes up through a column of heated coke where it is transformed into CO. This is taken off through the upper manifold.

This reactor offers these advantages over previous similar equipment: The ring electrodes should last for many months, since they are always under an atmosphere of dead gas. Because this vessel is gas-tight, it can be used on a batch basis for processes requiring pressure.

Where can you use it?

Carbonaceous reduction, calcining, chlorinating of titanium—these are a few of the applications suggested for this reactor. You give us your ideas. Lectromelt engineers have been dealing for years in problems of electrothermic reduction. Describe your problem and they'll help you solve it.

Whether you're expanding accepted processes or developing something new, we'll be interested in talking with you. Outline your thinking to Pittsburgh Lectromelt Furnace Corporation, 324 32nd Street, Pittsburgh 30, Pennsylvania.

Manufactured in ... GERMANY: Friedrich Kocks GMBH, Dusseldorf ... ENGLAND: Birlec, Ltd., Birmingham ... FRANCE: Stein et Roubaix, Paris ... BELGIUM: S. A. Belge Stein et Roubaix, Bressoux-Liege ... SPAIN: General Electrica Espanola, Bilbao ... ITALY: Forni Stein, Genoa. JAPAN: Daido Steel Co., Ltd., Nagoya

*REG. U. S. PAT. OFF.

WHEN YOU MELT... MOORE RAPID *Lectromelt*

100 miles per day

OPENED 40 YEARS AGO, THE QUARRY NOW PRODUCES 15,000 TONS OF MATERIAL DAILY

Most is put through large primary crusher on the following schedule:

DAY SHIFT

1. Limestone: bulk of tonnage shipped by rail.
2. Undersize stone: part made into agricultural lime; balance used for commercial stone.

NIGHT SHIFTS

3. Commercial stone: sold locally for highway and concrete work.
4. Sand: sold locally for highway and concrete work.
5. Rip-rap stone: supplied primarily to railroads.
6. Removal of overburden varying from 6 inches to 40 feet in depth. About half is stone suitable for local sales; the rest, low-quality stone and dirt, is dumped into worked-out sections of quarry.

for general clean-up tractor at large Eastern quarry

Thousands of tons of limestone and overburden are removed daily from this Eastern pit, one of the largest quarries in the country. Recently, to speed clean-up on the several hundred acre spread, the quarry owner replaced a crawler-tractor with a 186 hp rubber-tired electric-control Tournatractor.

This 19 mph unit proved so successful, it now works 3 eight-hour shifts daily, 5 days per week. Each day, it travels more than 100 miles around the pit to do its work — 40 to 45 miles on the day shift, 30 to 35 miles on each of the two night shifts.

All-purpose tool

Its major assignment on all shifts is to clean up for 2 shovels, located 1½ miles apart, and to maintain 2 overburden dumps. Traveling job-to-job at speeds to 19 mph, it usually makes 4 trips per shift to each of the shovels and 4 trips to each of the dumps. In addition to these 16 trips and 16 clean-up periods per shift, the versatile unit still finds time to do odd-lot tasks. Five or six times a day, it cleans up around the crusher. During travel between shovels and dumps, it helps a motor grader clean rock spillage from the haul roads.

Instant-shift, constant-mesh transmission enables this highly mobile unit to doze in and back away in a hurry, without delay to shovel. Torque converter eliminates jolting gear changes.

Despite its greater speed, men on the job report Tournatractor has been far less costly to maintain than track-type tractors. In 9 months of round-the-clock routine, the machine has been shut down only 3 times for minor repairs, not at all for major repairs. Its mechanical efficiency has been better than 95%.

"Tournatractor has done a good job — especially on shovel clean-up," says the assistant quarry superintendent. "Its mobility is very satisfactory."

"I like the rubber tires," adds the Tournatractor operator. "They get you to a job faster, and help you do the work faster. The fine seat makes work a lot easier, too."

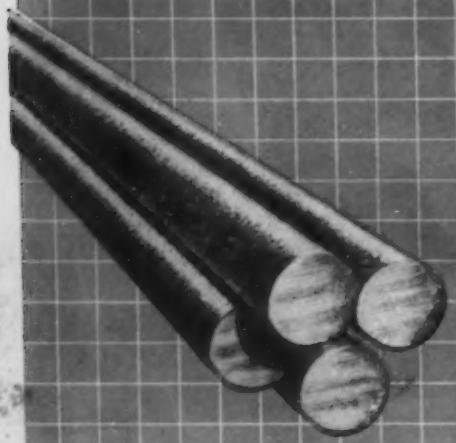
If your work involves abrasive materials, or jobs scattered around a large area, it will pay you to investigate Tournatractor. Ask for a demonstration!

Tournatractor—Trademark T-620-Q-b

LeTourneau-Westinghouse Company

PEORIA, ILLINOIS

A Subsidiary of Westinghouse Air Brake Company



CF&I GRINDING RODS

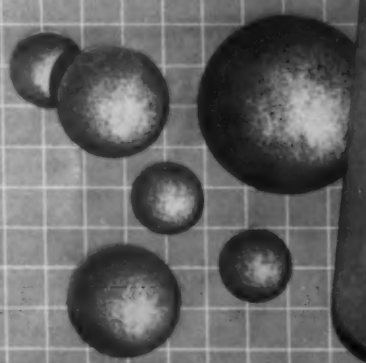
Rolled of special analysis steel, then carefully machine-straightened and cut to hold end taper to a minimum . . . increase rod life. Equally effective for fine crushing or coarse grinding.

be sure!

specify proven and dependable

CF&I MINING PRODUCTS

When you specify CF&I Mining Products, you are sure of receiving products that are perfectly designed for mining operations—for the complete line of CF&I Mining Products has been fully field-proven over many years of service and in our own mines. In addition, rigid quality controls give you positive assurance that CF&I Mining Products will provide trouble-free service throughout their long life.



CF&I GRINDING BALLS

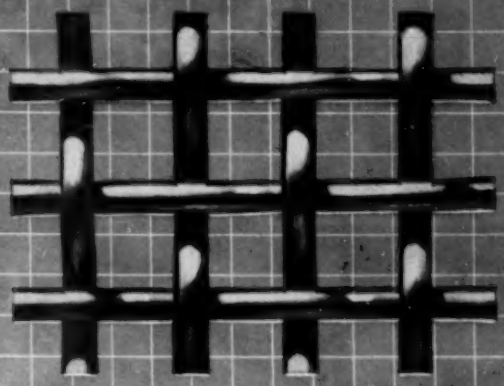
Forged of special analysis steel, CF&I Grinding Balls have built-in toughness to give optimum grinding ability and excellent wearability . . . provide better power transmission and high impact-resistance.

THE COLORADO FUEL AND IRON CORPORATION—Denver and Oakland
WICKWIRE SPENCER STEEL DIVISION—New York, New York

THE COLORADO FUEL AND IRON CORPORATION
CF&I

WICKWIRE ROPE

Known for its dependability for over half a century, Wickwire Rope is carefully controlled throughout manufacture to assure the maximum degree of strength, toughness and fatigue resistance—extremely important features in mining operations where the safety of men and protection of expensive equipment depend upon wire rope.

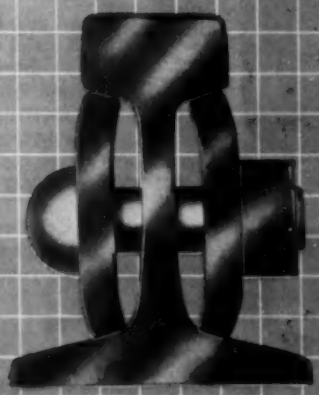


CAL-WIC INDUSTRIAL SCREENS

Woven to the most exacting tolerances, Cal-Wic Industrial Screens give unusually long life because they are tightly crimped to prevent hidden wear at the wire intersections. Wires can't work loose under even the most severe vibrations. Wide range of screen types and alloys available.

CF&I ROCK BOLTS

Enable progressive mine operators to economize and, at the same time, provide greater safety and better housekeeping in their mines. Available in either slot and wedge or expansion shell with Pattin shell types.



CF&I MINE RAILS AND ACCESSORIES

Available in the range of 12 to 45 pounds, CF&I Mine Rails meet A. R. A. standards. Accessories include splice bars, angle bars, spikes and track bolts and nuts (both square and hexagon).

Clarence Thom

Henry J. Gisler

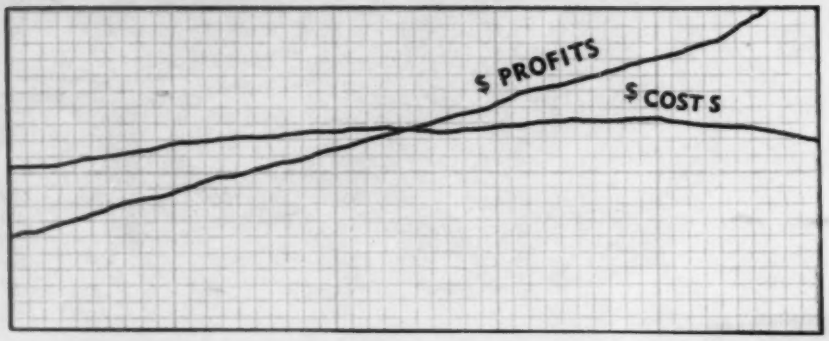
Leland Logue

Clifford F. Page

Frank A. Seeton

Henry C. Hurd, Jr.

Let These DECO Engineers Help You . . .



Have you or your engineers consulted us?

These DECO Engineers with their many years of field, operating, design and laboratory experience can help you INCREASE PROFITS and LOWER COSTS.

LONG EXPERIENCE

There is no substitute for long and varied experience. Our engineers are here to help you. Use their ability by submitting your problems to us. This consulting service is at no cost to you.

ORE TESTING

Send us a small sample by parcel post (10 to 15 pounds is usually sufficient). We will make a preliminary examination at no charge and give you a report on these preliminary findings. These reports supply facts for your future plans. DECO recommendations are accurate, unbiased and thorough. They are based on sound engineering and economic principles and will greatly accelerate the success of your project.

FLOWSHEETS

DECO Engineers will help you work out the flowsheet which will give you an operation that is simple, efficient and most profitable. Many typical flowsheets are at your disposal and may apply to your specific problem.

DESIGN

Your plant can best be designed by men who have been in that business for many years. After our many years of mill design and operation we have available for your use, typical mill designs and mill construction and operating costs. Machine templates will aid you in your layout work. Please write to us about your contemplated plans.

Complete batch and pilot plant testing facilities are available.

"The firm that makes its friends happier, healthier and wealthier"

DECO FLOTATION ENGINEERS — DENVER EQUIPMENT COMPANY 24 HOUR SERVICE

DENVER EQUIPMENT COMPANY

1400 17th Street • Denver 17, Colorado

Denver • New York • Chicago • El Paso • Salt Lake City • Toronto • Vancouver • Mexico, D.F. • London • Johannesburg

INTERNATIONAL TD-24 CRAWLER strips 6 to 12 feet of overburden to reach the vein. Next step is loosening rock of vein with giant hydraulic ripper mounted on 161 hp. TD-24.

"They Take a Beating But They're Always Back for More"

"INTERNATIONAL Crawlers Out-Perform, Outlast Other Crawlers in Our Pit," says Texas Iron Ore Miner

Any iron ore mining work is rough on a crawler tractor, but for pure punishment few can match the L. B. Haberle operation in Jacksonville, Texas.

On a 55-acre site on the outskirts of this east Texas town, Haberle is stripping 6 to 12 feet of highly abrasive overburden to reach an 18-inch vein of iron ore used by nearby ready-mix cement plants.

When Haberle's INTERNATIONAL TD-24 completes stripping work, it pulls an hydraulic ripper along the length of the vein. After rock has been loosened, it is loaded out by his INTERNATIONAL DROTT TD-9 Rock Fork bucket.

Haberle has standardized on INTERNATIONAL crawlers for all the heavy work. As he says, *"My* INTERNATIONAL *crawlers get the work done faster, with less cost.*

"Since I've had INTERNATIONAL *on the job, the production has had a substantial increase with no downtime on these crawlers. The sand used to chew up tracks and rollers on another tractor we had in a matter of weeks. But the* INTERNATIONAL *crawlers keep right on going without any signs of wear.*

"Lots of power and speed, too. I've had all makes of crawlers on my work but it's INTERNATIONAL *from now on."*

Whatever the job, big or small, a complete line of INTERNATIONAL machines with matched equipment lets you select the single machine or entire spread exactly suited to your requirements. Here's the lineup:

Eight rugged crawlers from 33 to 200 horsepower
Twenty-six hydraulic and cable-controlled bulldozers and *Bullgraders*
Four tractor-drawn scrapers from 10 to 27 cu. yds. heaped capacity
Two high-speed earthmovers
Four INTERNATIONAL DROTT Skid-Shovels from ⅞ to 3½ cu. yds.

Your INTERNATIONAL Industrial Power Distributor will show you how any of these machines can help increase production on your job. Call him today.

INTERNATIONAL HARVESTER COMPANY, CHICAGO 1, ILLINOIS

ORE IS LOADED out by Haberle's INTERNATIONAL DROTT TD-9 Rock Fork bucket. TD-9 picks up ore, shakes out sand, dumps ore into luggers where it is broken up before it is hauled to the crusher.

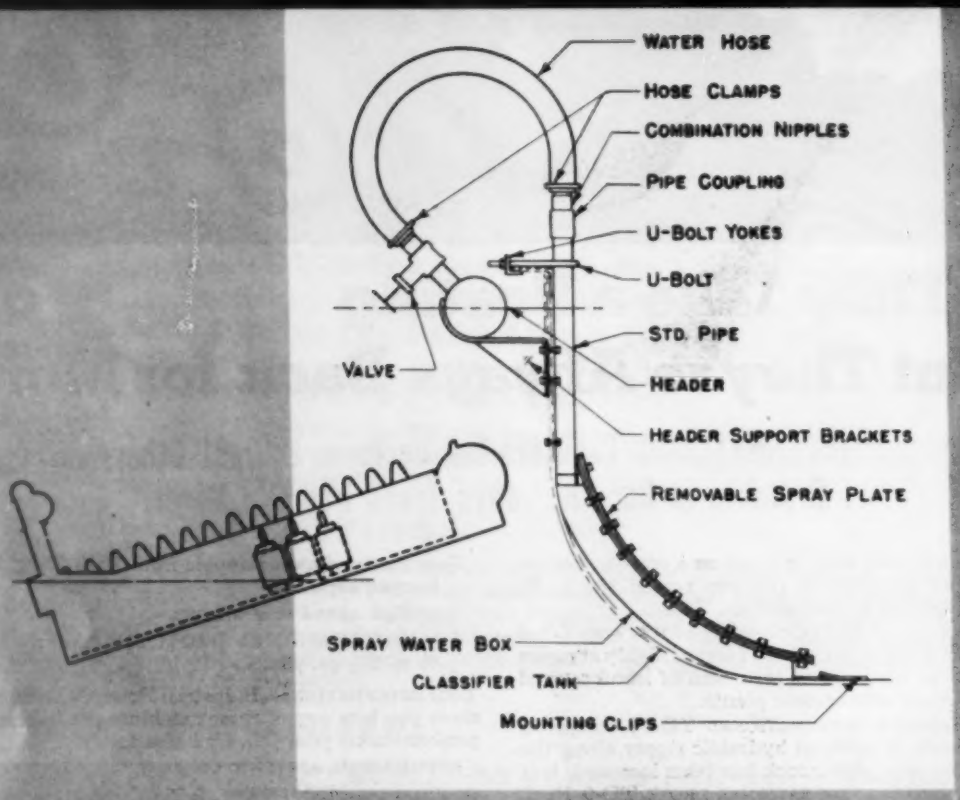
INTERNATIONAL HARVESTER

INTERNATIONAL
INDUSTRIAL POWER

MAKES EVERY LOAD A PAYLOAD

spray water box attachment on AKINS Classifier

solves difficult sand-washing problems



The Akins Spray Water Box was developed by Colorado Iron Works Co. in 1937 and has proved to be particularly valuable in cases where adhesion of slime particles to sand is so persistent that a clean separation cannot be made by normal classification.

Spray Water Boxes, generally furnished in multiple assemblies, are easily and quickly bolted to the standard Akins Classifiers and are placed at the lower end of the drainage deck. The top spray plate is gasketed and bolted for quick, easy removal and replacement when spray holes are blinded.

COLORADO IRON WORKS CO.

1624 17th Street • Denver 2, Colorado

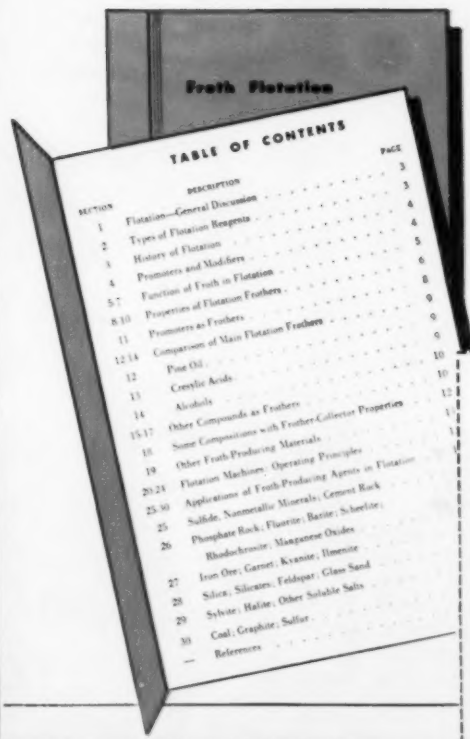
AKINS CLASSIFIERS • SKINNER ROASTERS • LOWDEN DRYERS

A SUBSIDIARY OF THE MINE & SMELTER SUPPLY CO.

Cyanamid REAGENT NEWS

"ore-dressing ideas you can use"

Now Available
Mineral Dressing Notes No. 21
Froth Flotation


Froth Flotation
TABLE OF CONTENTS
SECTION
DESCRIPTION
PAGE
1 Flotation—General Discussion 3
2 Types of Flotation Reagents 3
3 History of Flotation 4
4 Promoters and Modifiers 4
5-7 Function of Froth in Flotation 5
8-10 Properties of Flotation Frothers 6
11 Promoters as Frothers 8
12-14 Comparison of Main Flotation Frothers 9
12 Pine Oil 9
13 Cresylic Acids 9
14 Alcohols 9
15-17 Other Compounds as Frothers 10
15 Some Compositions with Frother-Collector Properties 10
19 Other Froth-Producing Materials 12
20-24 Flotation Machines: Operating Principles 13
25-30 Applications of Froth-Producing Agents in Flotation 15
25 Sulfide, Nonmetallic Minerals; Cement Rock 15
26 Phosphate Rock; Fluorite; Barite; Scheelite; Rhodochrosite; Manganese Oxides 16
27 Iron Ore; Garnet; Kyanite; Ilmenite 17
28 Silica; Silicates; Feldspar; Glass Sand 17
29 Sylvite; Halite; Other Soluble Salts 18
30 Coal; Graphite; Sulfur 18
— References 19

One glance at the Table of Contents tells why this comprehensive, 24-page, current basic summary of froth flotation should be among your everyday reference texts. The extensive bibliography of literature references is in itself invaluable since it lists principal flotation patents as well as technical articles.

Copies of Mineral Dressing Notes #21 were sent to all those on our technical mailing list. But mailing lists are difficult to keep accurate and complete. So, if you have not received your copy, may we suggest that you drop us a note requesting one or use the handy coupon below.

AMERICAN CYANAMID COMPANY
Mineral Dressing Department
30 Rockefeller Plaza, New York 20

NAME_____

TITLE_____

COMPANY_____

ADDRESS_____

AMERICAN Cyanamid COMPANY

MINERAL DRESSING DEPARTMENT

30 ROCKEFELLER PLAZA, NEW YORK 20, N.Y.

Cable Address — Limonitro, New York

NORTH AMERICAN CYANAMID LIMITED
Royal Bank Bldg., Toronto 1, Ontario, Canada
CYANAMID DE MEXICO, S. A.,
Apartado No. 26012, Mexico 12, D. F., Mexico

CYANAMID PRODUCTS, LTD., Bush House,
Aldwych, London W. C. 2, England
SOUTH AFRICAN CYANAMID (PTY.) LTD.,
P. O. Box 7352, Johannesburg, Union of South Africa

E. P. CADWELL, Casilla 12983,
Correo 11, Santiago, Chile
G. B. O'MALLEY, MALCOLM GLEN,
377 Little Collins St., Melbourne C. 1, Australia

Printed in U. S. A.

Here's a close-up of efficiency at O'Okiep Copper

TRAYLOR 22'
CASTING WHEEL

TRAYLOR 10' x 20'
COPPER CONVERTER

Both machines operating for 17 years

O'Okiep has been operating this Traylor machinery since 1938. Because of the efficient, dependable performance of their first Traylor converter, a second unit was installed 9 years later to expand production. In addition to the casting wheel and 2 converters, Traylor ladles and tilting devices are also used in the O'Okiep smelter.

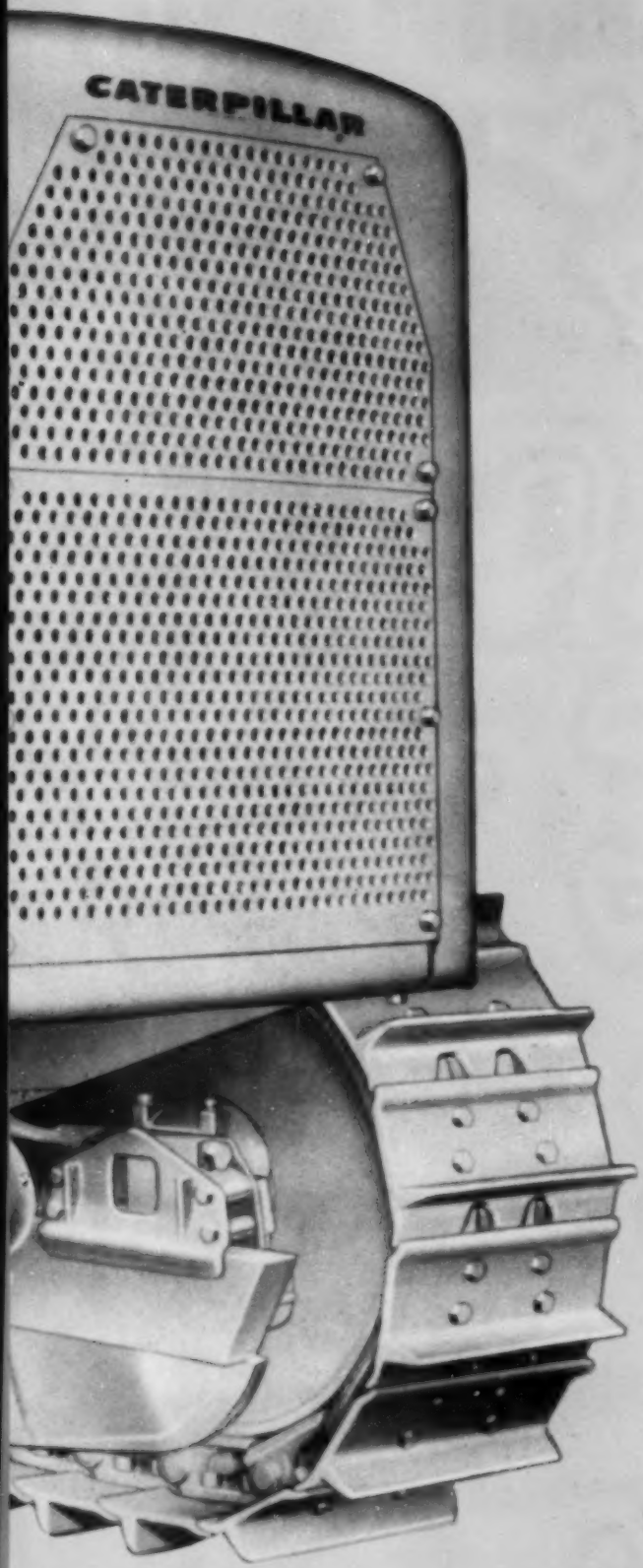
Traylor has supplied many other leading copper and nickel producers with converters of the Pierce-Smith type in sizes up to 13' diameter by 35' length. Traylor casting machines are supplied in 2 types . . . straight line or circular. Sizes up to 40' have been built. Like all Traylor machinery, both converters and casting wheels are "Traylor-made" for their job, thus assuring peak operating efficiency and economy.

TRAYLOR ENGINEERING & MFG. CO.
743 Mill St., Allentown, Pa.
Canadian Mfrs.: Canadian Vickers, Ltd., Montreal, P. Q.

A Traylor leads to greater profits

SEND FOR BULLETINS
. . . just mention the Traylor Equipment that interests you.

SALES OFFICES · NEW YORK · CHICAGO · SAN FRANCISCO



IT'S HERE ➧

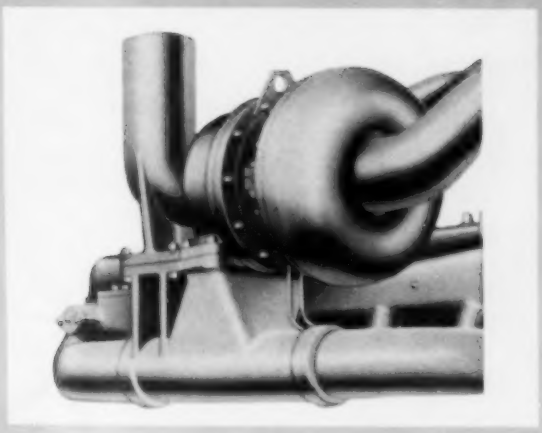
CATERPILLAR ANNOUNCES THE

D9

230 HP
(DRAWBAR)

56,200 LB.

... Caterpillar Leadership in Action!

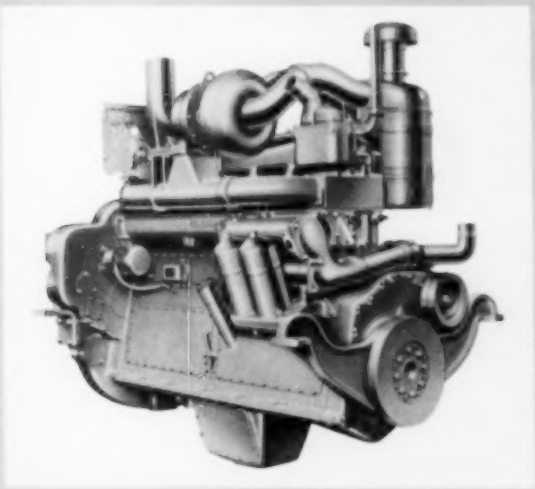


FIRST TRACK-TYPE TRACTOR WITH TURBOCHARGER!

The D9's new Turbocharger is driven by the engine exhaust, utilizing energy which would otherwise be lost. In addition, it packs air into the engine according to engine *load*, not speed. This means more working horsepower—greater performance.

CHOICE OF TORQUE CONVERTER OR DIRECT DRIVE!

Two types of drives are available, the exclusive Caterpillar oil clutch with six-speed (forward and reverse) transmission or a three-stage torque converter with 5:1 torque ratio. The transmission used with the torque converter has three speeds forward; two reverse. This option enables you to match the drive you want to your job requirements.



COMPLETELY NEW 286-HP ENGINE!

In addition to the Turbocharger, the powerful new D9 Engine features a 6¼" bore and 8" stroke and runs at 1200 r.p.m. Long life and dependability are promoted by stationary oil jet piston cooling; short, rigid valve push rods give smooth, accurate valve action; "Hi-Electro" hardened gear at the rear of the crankshaft drives timing gears and accessories; and many other advanced features.

WIDE RANGE OF OPERATING SPEEDS!

TORQUE CONVERTER:

3 speeds forward, 0 to 4.1 m.p.h., 0 to 5.7 m.p.h., 0 to 7.8 m.p.h.
2 speeds reverse, 0 to 4.1 m.p.h., 0 to 7.8 m.p.h.

DIRECT DRIVE:

6 speeds forward, 1.6, 2.1, 2.9, 3.9, 5.0, 6.8 m.p.h.
6 speeds reverse, same.

CONSTANT-POWER DRIVE FOR REAR-MOUNTED EQUIPMENT!

You always have power for cable controls, direct from the engine's rear power take-off. This makes cable control operation completely independent of flywheel clutch or torque converter and gives you a big boost in operating efficiency.

The D9 . . .
proven in the field for a year!

Though new, the D9 is already a veteran. After exhaustive proving-ground tests, several D9s have been tested for over 19,128 hours on the toughest jobs in logging, construction, mining and quarry work. These jobs tested every square inch of this mighty new machine. The word from the field: "By far the best big tractor ever made."

Rugged—
and easy to service!

From its one-piece welded steering clutch case-frame assembly, to its track shoes hardened by the "Water Quench" process, the D9 is the toughest crawler built. And it's designed for easy servicing. Oil clutch, torque converter, transmission case and steering clutches can each be removed individually without disturbing other components. Hydraulic track adjusters are among the many other features for fast, easy adjustment and service work.

Easy to operate!

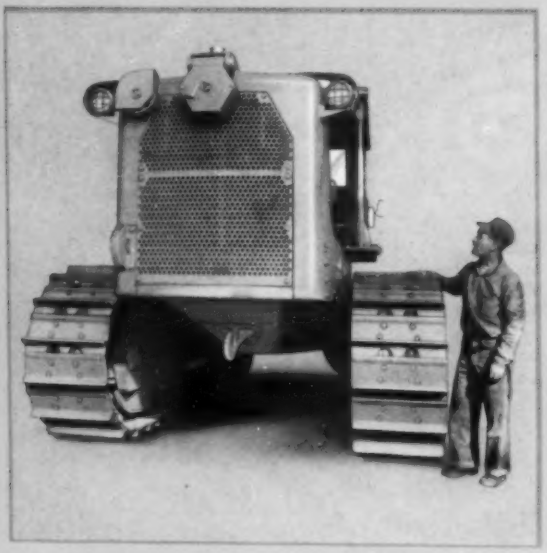
- The independent "live-shaft" drive for cable controls makes operation smoother, easier.
- Hydraulic boosters provide both power steering *and* power braking.
- Adjustable seat, all-around visibility, easy access to all controls make operator's job simpler.
- Important new 7-roller track frame improves stability, flotation and ride.
- New starting engine has electric starting system and simple single-lever control for easy operation from the seat and insures fast starts in all weather.

Equipment

New CAT*-built 'Dozers for the D9: the No. 9S Bulldozer, modified straight blade; the No. 9A Bulldozer, angling blade.

New Cat-built Cable Controls: the No. 29 rear-mounted, double drum; the No. 30 front-mounted, single drum.

Caterpillar Tractor Co., Peoria, Illinois, U. S. A.



Brief specifications

Length: 17' 10¼"
Width: 9' 11¼"
Height: 8' 9"
Gauge: 90"
Weight: 54,000 lb. approx., dry
56,200 lb. approx., operating

MAIL TODAY!
CATERPILLAR TRACTOR CO., Peoria, Illinois, U. S. A.
I'd like more information on the D9.
*Name*_____
*Company*_____
*Address*_____
*City*_____ *Zone*_____ *State*_____

CATERPILLAR*

*Both Cat and Caterpillar are registered trademarks — ®

**THE D9...
NEW KING OF THE
CRAWLERS**

PRINTED IN U. S. A.

COST-CUTTING MEMOS

Standard Engineer's Report

CASE HISTORY

PRODUCT Calol Vistac Oil

FIRM Victorville Lime Rock Co., Victorville, Calif.

One grade of oil ends desert heat-range problems!

CALOL VISTAC OIL 14X is the only lubricant tried that stays on pistons and other air-tool parts in spite of extreme temperature changes at the Victorville Lime Rock Co.'s quarry at Victorville, Calif. Temperatures range from 0°F. to 120°F. in this desert area, often change as much as 75° from early morning to afternoon. Oils previously used failed to stay in place except in a narrow range of temperature. Calol Vistac Oil 14X prevents excessive wear, sticks on bearing surfaces and helps keep them clean although tools constantly work in heavy abrasive dust around drills above.

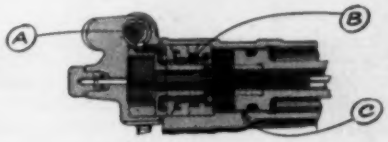
REMARKS: Quarry is in natural deposit of exceptionally pure calcitic limestone. Rock is ground to fine calcium carbonate, used for paint fillers and extenders, and for many other applications.

FREE CATALOG: "How to Save Money on Equipment Operation" will be sent on request to Standard Oil Company of California, 225 Bush Street, San Francisco.

FOR MORE INFORMATION about this or other petroleum products of any kind, or the name of your distributor, write or call any of the companies listed below.

CALOL

How CALOL Vistac Oil cuts cost in air-tool equipment



A. Atomizes quickly and completely—carries evenly over all parts. Does not fog excessively and has no unpleasant odor.

B. Additives help form tenacious oily, pressure-resistant film in wet or dry conditions—cuts wear and power loss. Small quantity lubricates efficiently.

C. Resists high temperatures and oxidation. Stays fluid at low temperatures.

TRADEMARK "CALOL" REG. U.S. PAT. OFF.

STANDARD OIL COMPANY OF CALIFORNIA
225 Bush Street • San Francisco 20, California

THE CALIFORNIA COMPANY
P. O. Box 780 • Denver 1, Colorado

STANDARD OIL COMPANY OF TEXAS
P. O. Box 862 • El Paso, Texas

COST-CUTTING MEMOS:

USE PROPER LENGTH LEG WIRES: Use leg wires long enough to initiate each blast at the point of maximum confinement, usually the bottom of the hole. Improve profits with more yardage per shot, better fragmentation, and fewer misfires. For dependable circuits, use the new ATLAS Twinplex assembly . . . extra long and strong. Tough plastic sheathing protects wire insulation in rough holes. Specially made for thrifty bottom initiation with Rockmaster* electric blasting caps.

COMPARE SAFETY ADVANTAGES: Wider use of Rockmaster* millisecond delays, both in open pit and underground, is due to the relatively greater safety they afford. Millisecond delay blasting often lessens danger from damaged roof supports . . . reduces risky successive-firing and secondary shooting. ATLAS Rockmaster "16" System improves stope fragmentation, makes easier slushing, and can substantially increase footage per shot—for greater savings.

CHECK RESULTS: Examine each shot for both breakage and displacement. Note methods used, existing conditions, and the amount of secondary shooting required. Surveying results with your ATLAS Representative can uncover ways to effect money-saving improvements. ATLAS Technical Service can help solve your blasting problems . . . give you better results, better profits.

ORDER WISELY: Advance-order your millisecond delays so that periods needed are always on hand: Stock a magazine for your particular needs with the aid of your ATLAS Representative. He'll help you select the right explosives and the Rockmaster blasting patterns best suited to each job. Continuous production and good breakage lower costs, boost profits.

BETTER BLASTING can cut costs and increase production per man hour substantially. A few cost-cutting ideas are shown here. Your ATLAS Representative knows many more, and can recommend those that specifically apply to your particular job. Check your present blasting methods with him. His suggestions may improve your profits considerably. And be sure to get "Better Blasting"—Atlas' periodical bulletin of latest methods and equipment. Put your name on our mailing list today.

ATLAS

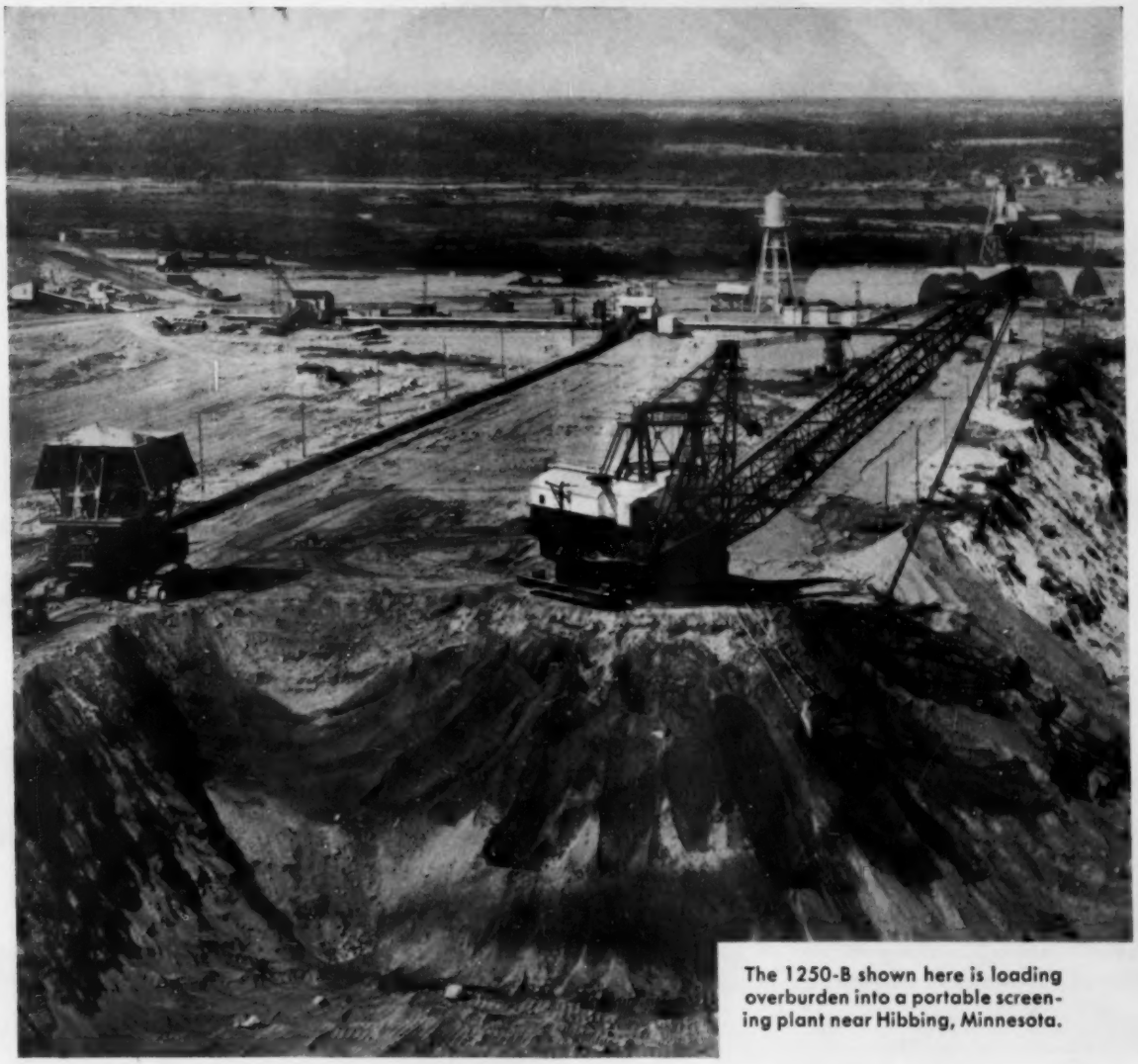
ATLAS EXPLOSIVES

"Everything for Blasting"

ATLAS POWDER COMPANY,
WILMINGTON 99, DELAWARE

Offices in Principal Cities

SAN FRANCISCO **PORTLAND**
SPOKANE **SEATTLE**



The 1250-B shown here is loading overburden into a portable screening plant near Hibbing, Minnesota.

No place for little ideas...

BUCYRUS ERIE

South Milwaukee, Wisconsin

On the Mesabi, stripping problems are big and ideas for solving them must measure up. The Bucyrus-Erie 1250-B walking dragline is the kind of answer to these problems that strip mine operators everywhere like. It offers really big output, along with dependability and economical operation.

With its exclusive Bucyrus-Erie walking mechanism, the 1250-B also saves moving-up time, is easy to maneuver into position. Control is sure and fast-acting. From boom-point to walking shoes, there's simplicity of design that means steady, dependable operation with minimum service and maintenance.

The men who deal in big ideas have made Bucyrus-Erie their first choice in walking draglines. 9154

CALL ON STANDARD

A ten-foot diameter *Standard* kiln is pictured above, ready to be shipped to its Louisiana destination. Lower photo shows kiln shell mounted on flat cars. Another car carries the enclosing furnace, trunnions and running gear.

Although by no means the largest kiln to be completed by *Standard*, it is a good example of our ability to design and build rotary processing equipment of any size—LARGE or SMALL.

In this, our 50th Anniversary Year, we take pride in the fact that for precision engineering and fabrication of heavy duty machinery, the call is so often for *Standard*.

Rotary KILNS

COOLERS
CALCINERS
DRYERS

ANY size
ANYwhere

STANDARD

WRITE FOR COMPLETE DESCRIPTIVE LITERATURE

STANDARD 50 YEARS

STANDARD STEEL CORPORATION

5031 Boyle Avenue, Los Angeles 58 • 15 Park Row, New York 31

"T5X...doing a good job here"

Carl F. Allebrand, contractor for Western Non-Metallics Co. at Ogilby, California, writes—

"T5X motor oil is doing a good job here... keeping our Universal shovel operating in this mica-talc quarry where dust conditions are quite extreme and temperatures of 135° and more are not uncommon.

"This same fine oil, which we use in all our equipment from pickup trucks on up, has also given excellent service in our GMC stationary diesel which drives the 75-KW generator powering our crusher plant. We ran this engine for five years or a total of 12,500 hours before it needed an overhaul. Believe me, we're completely satisfied with Union's T5X motor oil."

Mining operators all over the west agree that T5X is a great oil for gas and diesel engines when conditions are rugged and the going is rough.

If your present motor oil isn't delivering the kind of service Mr. Allebrand is getting from T5X, we suggest that you call your nearby Union Oil representative and place an order for T5X this very day.

UNION OIL COMPANY
OF CALIFORNIA

76

Los Angeles: Union Oil Bldg. • **New York:** 45 Rockefeller Plaza • **Chicago:** 1612 Bankers Bldg. • **New Orleans:** 644 National Bank of Commerce Bldg. • **Atlanta:** 401 Atlanta National Bldg. • **Kansas City, Mo.:** 612 W. 47th St

Same equipment—different jobs

Should you change wire rope constructions?

Under normal conditions there is one best size and type of Red-Strand rope for every wire rope using machine. This is the one you use day in and day out on your routine work.

But what about other conditions, the tough job, the unusual job? Suppose abrasion becomes a bigger factor, or unusual strength is needed, or more flexibility? Is a change of rope type in order?

Take a power shovel, for example. Moving dirt, sand, gravel, ore, it works fast handling smooth loads. If it is on a long job of clearing large rock, however, it will move slower and receive heavy jars and shocks. A different Red-Strand wire rope construction will probably absorb shocks better and last much longer than ordinary types.

Take *your* equipment for another example. Whatever your business and however you use wire rope—if unusual conditions arise call in your Leschen technical man. Leschen makes all types, knows the special advantages and qualities of every one, and can help you choose the rope that will do your job best—on shovels or any type of equipment. Leschen's Hercules Red-Strand wire rope is working profitably in every industry.

Your Leschen man can easily be reached through your nearby Leschen distributor. See him soon.

LESCHEN

HERCULES *Red-Strand*® WIRE ROPE

LESCHEN WIRE ROPE

Depend on Leschen's higher-than-rated quality for longer-than-expected service.

HKP

LESCHEN WIRE ROPE DIVISION
H. K. PORTER COMPANY, INC.
St. Louis 12, Missouri

Drifts and Crosscuts

Yearbook Authors

Right down to the final printing, material was being rushed to San Francisco from all parts of the world. When the Union of South Africa and South West Africa production statistics for 1954 were finally compiled, MINING WORLD had a correspondent waiting. The figures were immediately air mailed, but unfortunately the diamond figures were not ready. Space was left in the Mineral Production Tables and at the last moment they were inserted. Another African report interrupted an engineer's safari long enough for him to write his report from the bush. Most of the African section was actually written in Europe with last minute details coming by cable from engineers and geologists in the field.

Greatest thanks go to the geologist who found a typewriter with Roman characters, undoubtedly the only one in the whole country. Unfortunately it jammed. Hair oil failed to smooth its creaking joints and he was forced to spend most of the night typing with one hand while moving the carriage for each letter with the other hand.

Don't you think that the Yearbook contains more information about who did what in the mining world last year than you will find in any other book?

Tell us what you think so we can pass the word on to the engineers and geologists who supplied the information.

Will Miners Lose Another Right?

Under Public Law 585 the mining industry gave up all rights to leasable minerals which include coal, phosphate, sodium, sulphur, potassium, potash, oil, and oil shale.

Word from Washington is to the effect that plans are being drawn, and concurred with by some within the mining industry, for legislation to deprive the miner of his surface claimant rights before patent.

Don't be surprised at what may be proposed next.

Oriental Survey

George O. Argall, Jr. editor of MINING WORLD is now in the Philippine Islands on the first part of an extended mine examination trip to the Orient. Watch for his reports in future issues.

The Philippine section of the trip is being made with the cooperation of the Philippine Gold Producers Association, Inc.; the Philippine Iron Mines, Inc.; The Philippine Base Metal Producers Association; Philippine Iron Mines; A. Soriano y Cia; Atlas Consolidated Mining and Development Corporation; as well as all other Philippine mining companies.

While the Philippines have long been known as a major gold producer, few in the mining world realize that today the Philippines are in the midst of a "base metal boom." Also, that a new mercury district is being developed and that uranium exploration and development at one property is looking very favorable.

There will be much to see and report on for readers as the five largest mines produce from 1,000 to 4,000 tons of ore (copper, gold, chromite) per day. These ores are treated by a number of metallurgical processes including flotation, cyanidation, and heavy media separation.

Cover Speaks Again

One of the important reasons MINING WORLD grew so rapidly in its early days and why those early editions are still so widely remembered was the front cover. Yes, it was the most effective mining cover at that time and each month brought a new picture of what was going on in the mining industry. One month it was a Montana chrome mine, the next a California gold dredge, and yet another month a Montana copper smelter. Most importantly, the readers liked the cover and it is not unusual today to talk with an old timer and hear him say that the special article about the new way of cutting mining costs was in the issue that had the picture of the Bunker Hill smelter. He didn't remember the month but he knew it was MINING WORLD and what the issue looked like.

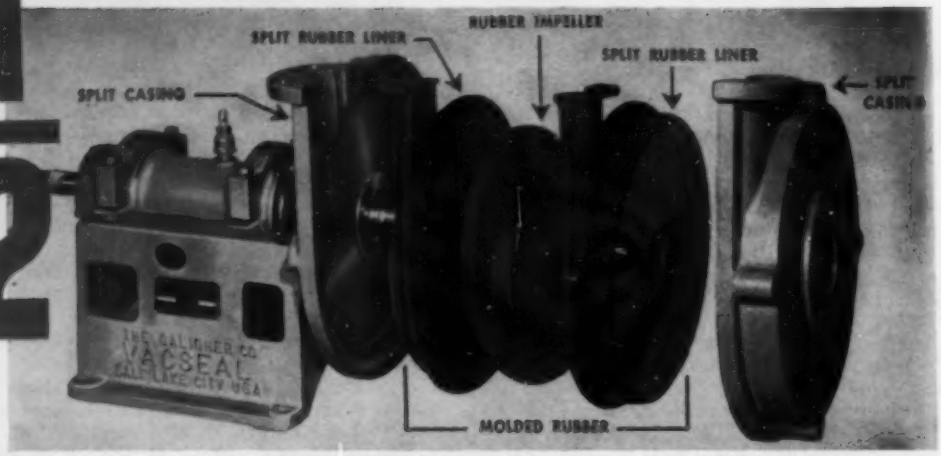
In 1946 the *Arizona Mining Journal* was combined with MINING WORLD with the First Consolidated Issue in May. The *Mining Journal* regularly carried advertising on its front cover so the August 1946 issue was the last to carry the photograph.

Since then MINING WORLD has grown in size, in circulation, and, most importantly, in stature within all segments of the mineral industry. Its policy remains unchanged to better serve the interests of the readers.

One way to be of greater service is to call the reader's attention to two or three of the most outstanding editorial features of the month. This meant re-covering for the good of the reader. In other words there won't be any more ads on the front cover. Giving up the advertising space has been a sacrifice to both MINING WORLD and the Eimco Corporation, but both know that it is a sound move and a service to the reader. Happily for all, Eimco ads will be carried inside. The cover space will be given to the editors to tell what's inside the cover. The editors guarantee that the cover won't follow any set pattern. There will be photographs, drawings, maps, and maybe just headline type. This will permit each cover to be adapted to the best features of the particular month.

There's an old saying that you can't judge a technical magazine by its cover. Maybe so, but a cover can give some idea of what's inside and at least invite you to look. Hope you will like it.

1½" VACSEAL PUMP



Latest addition to the Famous VACSEAL Family

The 1½" VACSEAL pump embodies all the fine features of the larger VACSEALS, plus replaceable molded rubber liners — tailor-made of the right type rubber to handle your specific material, even under adverse conditions of temperature, abrasion and/or corrosion.

CONSTRUCTION — Rugged — Compact.

SPLIT CASING and split liner simplify replacement and provide low-cost maintenance. The rubber liner is non-collapsible, a feature that eliminates flutter and increases liner life.

GLAND operates dry without sealing water.

ACID PROOFING — furnished at no extra cost.

PERFORMANCE

HEADS - - - to 80'
CAPACITY - to 150 GPM
SLURRIES - to 70% solids

Galigher engineers are at your service through correspondence or personal conference. Submit your problem to men who know!

OTHER GALIGHER PRODUCTS

Commercial and Laboratory AGITAIR
Vertical VACSEAL Pump
Acid-proof Sump Pumps
Laboratory Ball Mills
Geary-Jennings Sampler
Geary Reagent Feeder
Laboratory Pressure Filters

Leaders in Experience & Service

THE GALIGHER CO.

METALLURGICAL DIVISION · ENGINEERING SERVICE

CONSULTATION · ORE TESTING
PLANT DESIGN · GEOLOGIC INVESTIGATION

HOME OFFICE: P. O. Box 209 • Salt Lake City 10, Utah
EASTERN OFFICE: 921 Bergen Ave. (Room 721) • Jersey City 6, N. J.

Capitol Concentrates

Office of Mineral Mobilization Plans Questioned at House Interior Hearing

The mining subcommittee of the House Interior and Insular Affairs Committee recently held a hearing to determine, if possible, the functions of and reasons for setting up the new Office of Minerals Mobilization within the Interior Department. Actually, the subcommittee learned very little except that the OMM will have 37 employes under Spencer Shannon, formerly of the National Security Resources Board (defunct), and that Assistant Secretary Felix Wormser would supervise it.

According to reports, Representative Engle of California remarked that this is just another shell placed on the table without a pea under it.

The subcommittee labored hard and long, questioning the government witnesses from OMM and the Office of Defense Mobilization, to find out just what OMM is supposd to do that ODM has not done with just a handful of employes and how long it would take to do whatever it is supposed to do. On the one hand, ODM witnesses testified that it has the stockpile program in good shape; and on the other hand, Secretary Wormser, in a vague sort of way, testified that when plans and programming were completed, OMM expected to review each mineral separately from the standpoint of national security, stockpiling and the national economy. Persistent questioning as to the line of authority elicited the statement that where national defense is involved ODM Director Flemming would have the final decision, and in matters concerning the national economy Secretary of the Interior McKay would have the final say, both, of course, subject to review by the President. The point that the two areas frequently overlap, and are sometimes in conflict was never resolved.

The principal reason given by Secretary Wormser for the new agency and putting it into the Interior Department was that then OMM could snuggle up to the U. S. Bureau of Mines and the United States Geological Survey and ask their advice. As the Office of Defense Mobilization has every agency of the government at its beck and call, this reason seemed a little thin.

Actually, it seems as though 37 people were about to re-do what six or eight did before, unless experience with OMM proves otherwise, and in the long run ODM has to make the decisions anyway. As to the time element, which the committee never found out about, the reviews will have to go on forever or the agency will work itself out of business, which is unthinkable. Agencies never die, though they often are merged.

• Silver Act Is Under Fire

Senator Theodore Green of Rhode Island, together with Senators Bush, Douglas, Kennedy, Pastore, Purtell and Saltonstall, has introduced a bill (S. 1427) to repeal the Silver Purchase Act. The bill follows the pattern of the one which has been introduced year after year by Representative Celler of New York. It is, however, the first major assault on silver for some years in the Senate. The success of this attack would render still more difficult the position of those lead-zinc miners who depend on silver content in their ores.

Senator Green maintains that "the record clearly indicates that the problems of the lead-zinc miners must be solved by other methods than the present silver-purchase laws." Unfortunately, the good Senator failed to come up with a plan. He also remarked that he hopes Congress will deliver his silver-using constituents "from the grip of these selfish interests . . .", evidently meaning the mining industry. The price of 88.5 cents, according to Senator Green, is much too high. "No other commodity has been so rigidly controlled," he remarked in a Senate speech.

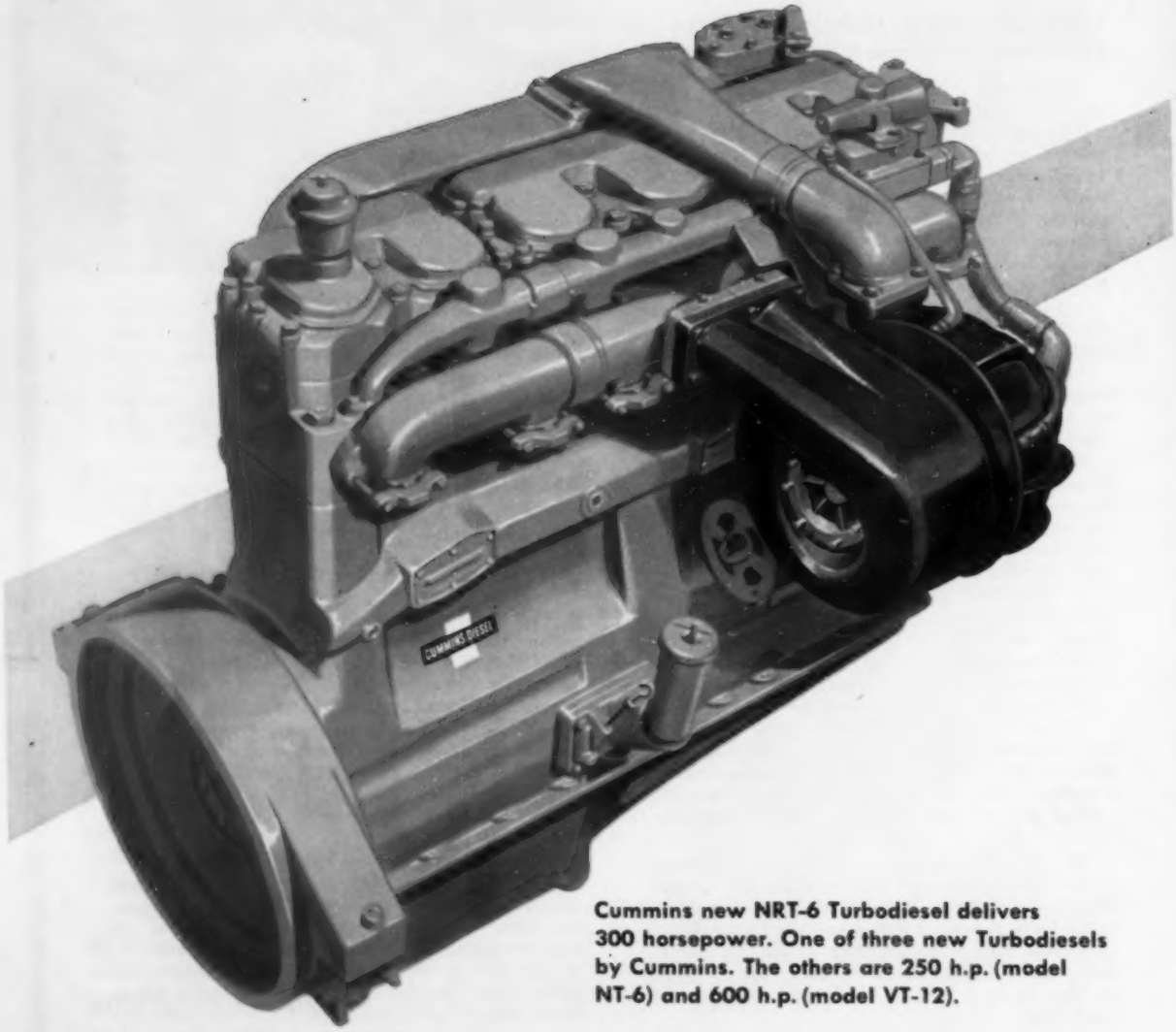
• What Price Level Is Needed?

The hearings of the House Interior and Insular Affairs subcommittee, investigating the functions of the Office of Mineral Mobilization, brought out the point that a study might be made of the feasibility of subsidies for maintaining a healthy domestic mining industry. As has been pointed out many times, if the Administration will not accept the idea of increased tariffs or import quotas, and the long-term stockpile purchase idea as a mechanism to support prices has definite limitations both as to quantity and the price-support point, the answer is either subsidies or, in many cases, no industry.

The fluorspar producers are in this fix right now. In Illinois, the miners and their families are on relief, county funds are exhausted, and there is not even enough money to pay the freight on allotments of government surplus foods. Senator Dirksen, together with other Senators, has introduced a bill to fix import quotas on fluorspar, but it probably will receive rough treatment from the White House.

One statement made at the hearing by a representative of the Secretary of the Interior was really arresting. He said that to his knowledge no agency as yet has determined for each mineral the economic level at which support prices would preserve a healthy mining industry. The implication was that the new Office of Minerals Mobilization, recently created within the Interior Department, would make such studies. Certainly it is high time some agency did this.

NEW TURBODIESEL



Cummins new NRT-6 Turbodiesel delivers 300 horsepower. One of three new Turbodiesels by Cummins. The others are 250 h.p. (model NT-6) and 600 h.p. (model VT-12).

Cummins Arizona Diesel, Inc.

Phoenix	1350 No. 22nd Ave.	ALpine 8-2668

Cummins Intermountain Diesel Sales Company

Salt Lake City	1030 Gale St.	22-5823

Cummins Diesel Sales of Colorado, Inc.

Denver	2450 Curtis St.	Acoma 2-5933

Watson & Meehan

San Francisco	1960 Folsom St.	Market 1-8930
Fresno	248 Palm Ave.	4-3096
Redding	1127 Parkview Ave.	2840

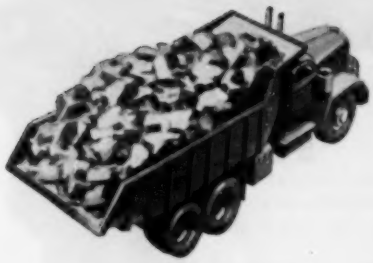
Cummins Diesel Sales Corporation

Hibbing	Hwy. 169 W., Box 159	3-7558
Duluth	2319 W. First St.	Randolph 7-6851
Iron Mountain	723 River Ave.	502

Authorized distributors for Cummins Engine Company, Inc., Columbus, Indiana

4-8-55

BY CUMMINS



ups your production

and lowers your costs!

Cummins 300 h.p. turbocharged NRT-6 pulls full loads faster, permits higher speeds on grades, cuts cycle time, because it produces greater horsepower without increase in engine size or displacement.

Turbocharging—which harnesses exhaust gases normally wasted—produces this extra horsepower by achieving a more perfect air-fuel mixture in the combustion chamber. There is no parasitic load as in supercharged engines. This means drastically reduced fuel costs . . . fewer internal stresses . . . longer engine life.

In addition, Cummins exclusive PT fuel system is simple and trouble-free . . . makes fuel system maintenance costs negligible. It is so easy to understand and work with that no specialists are needed. And all Cummins Diesels run on inexpensive No. 2 diesel fuel or furnace oil.

For further information, see the Cummins distributor in your area, or send us this coupon today.

CUMMINS

Cummins Engine Company, Inc.
Columbus, Indiana

Leader in rugged, lightweight, high-speed diesels (60-600 h.p.)

Cummins Engine Company, Inc.
Columbus, Indiana

Please send me detailed information on Cummins new NRT Turbodiesel.

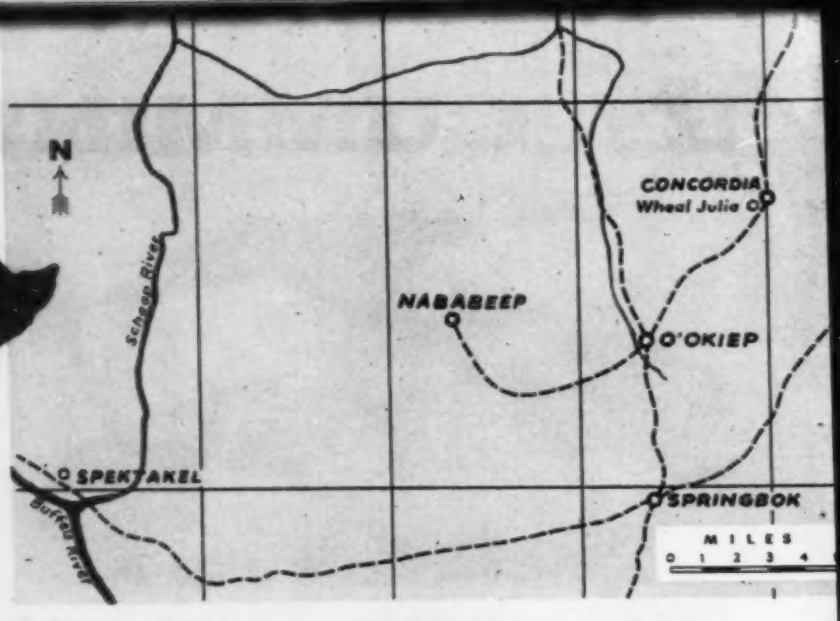
Name _____

Company _____

Address _____

City _____ Zone ____ State _____

MW-5



	NABABEEP		O'OKIEP		WHEAL JULIA MINE	SPEKTAKEL MINE
	NABABEEP MINE	TUNGSTEN MINES				
UNDERGROUND MINES*	S. SECTION 27,000-28,000 TONS PER MO. N.E. SECTION 16,200-16,800 TONS PER MO. E. SECTION 10,800-11,200 TONS PER MO.	NABABEEP NEAR WEST MINE FAR WEST MINE EAST MINE TWEEDHAM MINE	EAST O'OKIEP MINE	WEST O'OKIEP MINE	25,000 TONS PER MONTH ORE TRUCKED TO O'OKIEP MILL	
CONCENTRATING MILLS	1,900 TONS PER DAY FLOTATION	200 TONS PER DAY GRAVITY	1,900 TONS PER DAY FLOTATION CONCENTRATE TRUCKED TO NABABEEP SMELTER			
SMELTER	28,000 TONS OUTPUT BLISTER COPPER PER YEAR					
SULPHURIC ACID PLANT			H_2SO_4 PLANT 45 TONS 68° ACID PER DAY			
LEACHING PLANT	500 TONS PER DAY TANK LEACHING PLANT		HEAP LEACHING DUMPS			HEAP LEACHING DUMPS
POWER PLANTS	DIESEL AND STEAM-ELECTRIC PLANTS		DIESEL AND STEAM-ELECTRIC PLANTS			
TOWN	COMPANY HEADQUARTERS EMPLOYEE HOUSING AND RECREATION FACILITIES		EMPLOYEE HOUSING AND RECREATION FACILITIES			
LIME PLANT			250 TONS PER MONTH LIME PLANT			
SHOPS	MAIN SHOPS					

*MINES UNDER DEVELOPMENT

VALENTINE MINE

NABABEEP WEST MINE

NARRAP MINE

ORE WILL BE MILLED AT NABABEEP

First Report: O'okiep Copper

How aggressive management at this South African copper center Makes new methods pay off in building an integrated operation

The O'okiep Copper Company, Ltd. is controlled and managed by the Newmont Mining Corporation. It is one of the world's lowest cost per pound copper producers despite the fact that all mining is underground. The efficiency of the operation is noteworthy, and is indicated by the operating returns for the fiscal year ended June 30, 1954 when metal sales were $12,569,701 and net profits were $6,575,601.

O'okiep is truly one of the world's great mining operations. MINING WORLD *is honored to present this special report written by the O'okiep staff. Ed.*

The O'okiep Copper Company's property is situated in the northwest corner of the Cape Province of the Union of South Africa at latitude 29°40′ south and longitude 18° east. The principal operating centers are at the villages of Nababeep and O'okiep with administrative offices being located at Nababeep.

Elevation is 3,100 feet above sea level with a relief of some 1,000 to 1,500 feet giving an attractive, rolling, koppie-studded topography. The climate is on the temperate side of subtropical and generally is very pleasant. Yearly average maximum and minimum temperatures are 85° and 50° F.

The villages of Nababeep and O'okiep are accessible from Cape Town by some 360 miles of good, all-weather road, or by rail to Bitterfontein and thence further by bus 125 miles. The company operates a jetty, at Port Nolloth, some 85 miles by road from O'okiep, over which it handles a portion of its own, and of the general public's goods.

The presence of copper was reported in Cape Town during early colonial days. Governor Simon van der Stel outfitted and led an expedition to the site of the present mines in 1686. Although the surface showings were investigated at this early date, no actual mining was started until about 1850 when Phillips and King initiated mining operations at Springbokfontein —now Springbok. Their first shipment of copper-bearing material was made in 1852 which event is now taken as marking the commencement of copper production in the district.

The Cape Copper Mining Company was organized in 1863 and carried on operations until 1888 on the property which now forms the principal O'okiep holdings. This company was succeeded in 1888 by the Cape Copper Company Limited.

Five years after the Cape Copper Company went into receivership its South African properties were optioned in 1927 to the South African Copper Company Limited, a United States group which reopened some of the old mines and carried on a campaign of underground and surface exploration. The O'okiep Copper Company Limited was incorporated on 25th May, 1937, and acquired by purchase, all of the assets and liabilities of the South African Copper Company.

Another group of 11 mines and prospects about six miles northeast of the village of O'okiep was operated by the Namaqua Copper Company until 1929. In 1939, leases covering this ground were purchased by the O'okiep Copper Company Limited.

O'okiep started installing new plant at Nababeep and rehabilitating the Nababeep South mine in 1937. Milling operations were started in early 1940 with smelter production following in August of the same year. A mining, milling, and power plant was completed at O'okiep and the East O'okiep mine came into production in April, 1945. A mining plant was completed at Wheal Julia and this mine came into production during the latter half of 1951.

After the milling of over 11,000,000 tons of ore current reserves are sufficient to sustain present rate of production for a further 20 years. This happy situation is due to the company having maintained a firm policy of vigorous search for ore.

Tungsten occurrences on company property have been exploited, from time to time, during the war years in the interests of the war effort and at other times when deemed economically advisable. Under a long-term contract for the sale of cencentrates they are being worked now at a milling rate of 200 tons per day.

Two major townsites at Nababeep, and O'okiep, and a smaller one at Wheal Julia, are maintained where rent-free housing is provided for all married European employees and where accommodation is available for single European employees for some £ 14.14.0. per month.

Two large and commodious Recreation Clubs are maintained at Nababeep and O'okiep, and a smaller one at Wheal Julia, for the use of company employees. There are swimming baths at the first two. Facilities are also available for tennis, golf, rugby and other outdoor sports. The company operates a large and fully equipped hospital for the care of injured and sick employees and their families.

J. M. MacLEOD
General Manager

J. H. VOSE, JR.
Assistant Manager

SURFACE MAPPING and geologic detailed studies led to discovery of non-outcropping high-grade ore body at Wheal Julia.

How Geology and Geophysics Add Ore Reserves By Finding Buried Deposits

By D. De N. WILD

The O'okiep copper district occupi s only a small portion (about 15 by 40 square miles) of a large basement platform that comprises most of the northwestern Cape Province and a considerable part of South West Africa. The geology of this vast region has not been worked out in detail, although large parts are known to be built up of variably granitized sediments and lavas. Deposition, mountain building, and granitization are believed to have been effected in early Pre-Cambrian time, as a regional unconformity separates the complex from the late Pre-Cambrian Nama formation, outcrops of which occur in various parts of the region. This younger formation displays relatively little deformation and in general a much lower grade of metamorphism.

Because of its importance as a copper-producing center, the O'okiep copper district itself however, has received considerable geological attention, especially over the past eight years, during which period an intensive exploration program has been carried out by the present owners, the O'okiep Copper Company, Limited. This work, which consists of detailed mapping (surface as well as underground), geophysical surveying (magnetic and electrical methods), diamond drilling (about 100,000 feet per year), and laboratory research (chiefly microscope work), has resulted in the discovery of several new mines, and, in addition, in the disclosure of certain very interesting geological features, the examination of which has been greatly facilitated by the excellent opportunities provided by exploration and mining activities, and by the abundance and fresh condition of the outcrops themselves.

General Geology

The district is built up of the following rock units: (1) a thick conformable succession of layered rocks consisting chiefly of foliated gneisses, with subordinate granulites, schists, and quartzites; (2) occasional masses of granite, occurring usually in close association with certain members of the layered series; (3) thin sheets and narrow dikes of medium and coarse-grained pegmatite, distributed along foliation and fracture planes in the country rocks; and (4) large numbers of relatively small irregular-shaped basic bodies of mixed and varied composition; this group includes the copper ore-bearers of the district.

Layered Series: This unit, which occupies about nine-tenths of the total area

D. De N. WIID
Chief Geologist

E. W. HUNT
Consulting Engineer

of the district (not counting the portion covered by the Nama), has been correlated by the Union Geological Survey with the Kaaien Series, a predominantly sedimentary sub-division of the early pre-Cambrian Kheis System. Locally the sedimentary origin of certain members of the series has been obscured by effects of granitization; yet such an origin is assured (1) by implication of the existing correlation; (2) by the presence of some distinctly sedimentary schists; (3) by the conformable relationship between these schist layers on the one hand, and the over and underlying granulite and gneiss members on the other; (4) by the abnormally high alumina content of certain of the gneisses; (5) by the rounded condition of the zircons in the gneisses; and (6) by numerous examples of lateral gradation from schist through granulite into gneiss.

The foregoing series occurs in the form of a large easterly-striking doubly-pitching anticline—the so-called Springbok anticline—with axis about midway between Springbok and O'okiep (see map). This anticline dominates the structure of the district and controls to an important degree the distribution of the various members of the meta-sedimentary series.

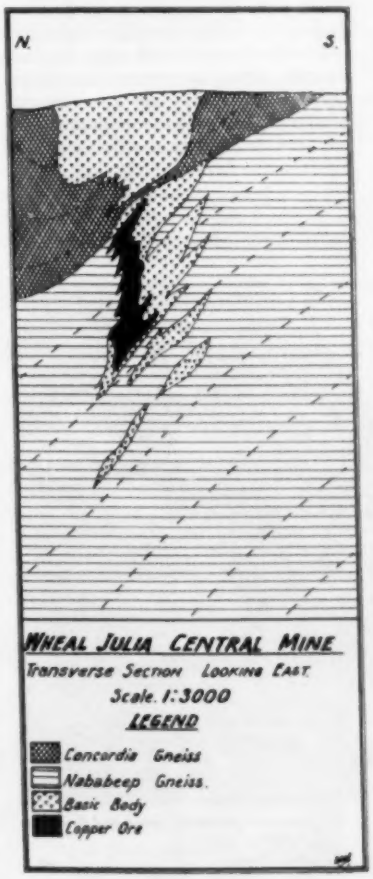
Granite: Under this heading are included all rocks of granitic texture in which the dominant minerals are quartz and potash feldspar. Exposures answering to this description are widely scattered and few of them have been studied in detail. Probably the combined area represented by the known exposures would amount to something like one-fourteenth to one-twelfth of the area of the district as a whole. The best known exposure is that of the so-called Modderfontein granite, which occurs in association with the Brandberg gneiss in the central portion of the Springbok anticline. This granite consists of grey to pinkish, medium to coarse-grained, porphyritic rock, composed essentially of quartz, microcline, oligoclase and biotite. Contacts with the Brandberg gneiss are gradual, regular and often transgressive. Nowhere is there evidence of bodily intrusion.

Other less well known masses are those of Brandkloof, Rietberg, and Nigramoep in the north and northwestern part of the district, and of Ezelsklip in the south, two miles east of Springbok. Some of these masses, notably that of Rietberg which consists of a pinkish-grey to red, fine to coarse-grained porphyritic rock composed of bluish opalescent quartz, microcline and biotite—bear most of the earmarks of normal intrusives. Such an origin is rendered doubtful, however, by lack of chill phases, absence of deformation of the country rock, and by the close chemical and textural correspondence existing usually between the various granite masses and their respective wall rocks.

Pegmatites: Sheets and dikes of pegmatite are widely distributed in the copper district, although they are not nearly as well developed here as in the area towards the north and northeast. Altogether they account probably for a hundredth to a fiftieth part of the total area of the district.

The sheets occur along foliation planes in the meta-sediments, and are seldom more than two feet thick. As a rule they are relatively fine-grained, while their composition is quite simple, quartz and feldspar being the only essential minerals present. Thicker, coarser-grained, and more complex varieties, however, are found sometimes in places where the country rock consists of schist.

The dikes, on the other hand, occur along steep-dipping faults, in thicknesses up to 15 and 20 feet. The thicker examples are usually also the coarser in grain and the more complex in composition. Mica is a very common constituent, while minerals such as magnetite, ilmenite, titanite, rutile, scheelite, euxenite, and even monazite, are frequently present in small amounts.



The Basic Suite

This suite, which has been referred to in the past also as "the noritoid suite," "the norites," "the diorites," and even "the monzonites," is represented in the field by about a thousand or more separate outcrops, varying in size from less than 100 to more than 300,000 square feet, and occupying altogether about a one-two hundredth part of the total area of the district. Although irregular in shape, the outcrops are usually elongated in an easterly direction, some of them occurring as narrow strips, 20 or 30 feet wide and a mile or more in length. Though small, they are as a rule very conspicuous in the field, owing to the dark brown color to which they usually weather. Many of them display green copper staining.

Although the outcrops are scattered in all directions, their common easterly trend led early investigators to believe that they represented the tops of a series of parallel, incompletely exposed, dikes. This has not been confirmed by subsequent exploration and mining, which has shown instead that they are underlain by a host of separate and completely isolated bodies. Not only are they not connected by lateral extensions or by hidden parent bodies, they themselves pinch out in depth. In fact the deepest extension that has been found to date is only about 2,000 feet.

Exploration and mining have furthermore shown these bodies to occur in an odd variety of shapes. The commonest form is perhaps that of a steeply inclined, highly irregular, dike-like lens, although sill-like and pipe-like forms are common also. This diversity of form is of course partly real, but is partly due to unequal erosion of the different bodies. If the latter effect were allowed for, the most typical form would probably be that of a steep, irregular, pinch-and-swell, dike-like lens, with sill-like protuberances along the sides. Most of the known bodies can be fitted into this description (see accompanying section).

As regards composition, detailed mapping and core-logging have shown the suite to consist of an oddly assorted mixture of the following petrographic types: syenites, quartz anorthosites, anorthosites, quartz diorites, mica diorites, mica-hypersthene diorites, hypersthene diorites, norites and

hypersthenites. Less common types, frequently associated with these, are the so-called mica-apatite rock (composed almost entirely of biotite and apatite), and magnetite-apatite rock (consisting mainly of magnetite and apatite).

Relationships with the country rocks are complex. Contacts with schist are as a rule, vague, while those with gneiss are generally sharp. Drag structures displayed by the wall-rocks point upward in some cases and downward in others. Orientated inclusions of gneiss and schist within the basic bodies themselves are common.

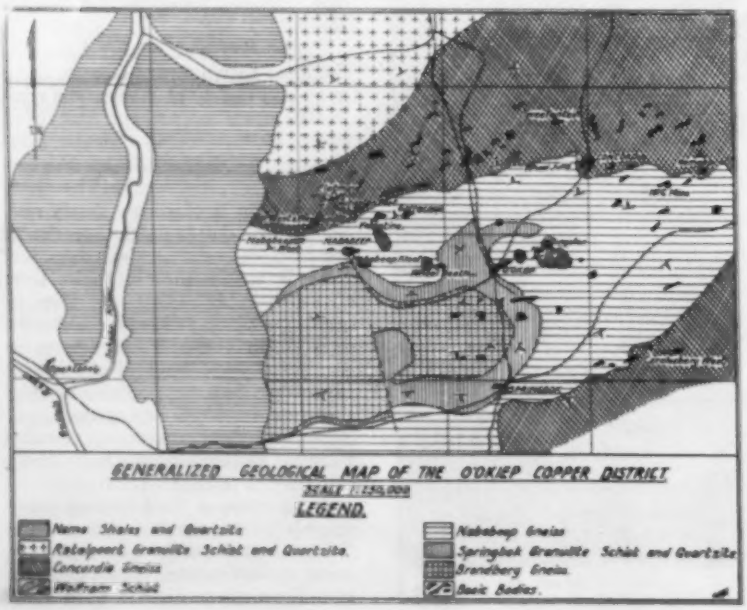
Origin of The Basic Suite

Although there are several possible explanations for the rocks of this suite, only two need be mentioned here. The one is that the bodies were formed by crystallization of small isolated pools of magma, derived from a deeper source by way of faults that have since become healed; the other is that they were formed from local accumulations of basic materials segregated from the original sediments during the process of granitization. The former has the advantage of being backed by firmly established notions arrived at by experience with related rock types in other parts of the world, while the latter is based solely on evidence of the local rocks themselves.

Mineralization

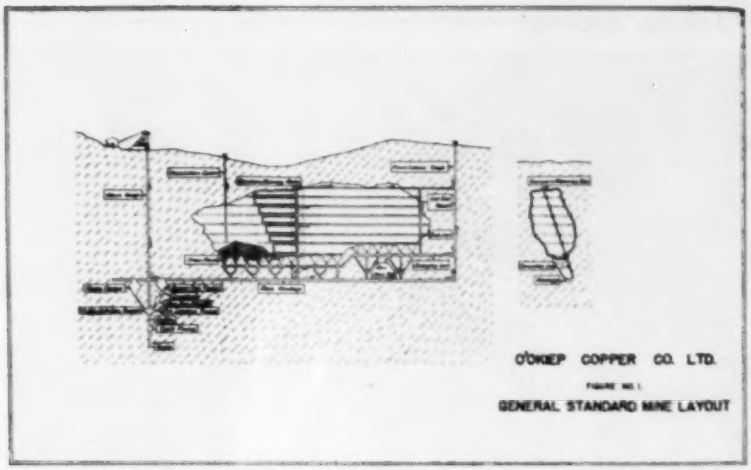
The green stain present in some of the outcrops of the basic suite consists usually of mixtures of brochantite, chrysocolla, and malachite, represented in that order of abundance. Below the oxide zone, which usually extends to depths of less than 70 feet, the copper minerals are bornite, and chalcopyrite, with chalcocite, associated with bornite, a rare third. Although the chief copper minerals, bornite, and chalcopyrite, generally occur together, the former predominating in some mines and the latter in others, they may also occur singly. Where they occur together, the chalcopyrite/bornite ratio is frequently higher in the upper than in the lower portion of the ore body. The latter is then generally also the higher grade part of the body. Where chalcopyrite is the only copper ore mineral, pyrrhotite, with or without pyrite, is a common associate. Where bornite occurs alone, magnetite is a common associate, although this mineral, accompanied by hematite, may also be present in the chalcopyrite/pyrrhotite ores. Other sulphides that may be present in small quantities are: pentlandite and millerite, occurring as accessories in pyrrhotite; covellite, associated with bornite-chalcocite ore; siegenite, which has been found only at one place, in bornite, rimmed by chalcopyrite; and cubanite, which has been found only in chalcopyrite. Other accessories, associated with all types of ore are: galena, sphalerite, molybdenite, melonite, and valleriite. Ilmenite is usually present as fine lamellae in magnetite.

The copper ore minerals occur in finely disseminated form, as well as in coarser aggregates with interconnecting veinlets, and in massive form. Ore-grade mineralization occurs in the form of irregular bodies which lie wholly within the bodies of the basic hosts themselves, although in some cases mineralization may extend for distances of two to three feet into the adjoining country rock. The coarse to massive high-grade type of ore bodies are as a rule sharply defined, while the disseminated low-grade type are generally fringed by material of doubtful to subeconomic grade. Although many of the basic bodies display some copper mineralization, only a few contain ore bodies of commercial grade. Evidence of hydrothermal alteration is as a rule very slim. Most of the indications point to the ore having been brought in with the material of the basic suite.



Anticipate More Discoveries

Mining has now been in progress in this district for more than 100 years. As could be expected, early production came almost entirely from high-grade ore bodies that outcropped on surface. Under this category fell mines like West O'okiep, Tweefontein, Homeep No. 6, Nababeep North Mine, and Spektakel. These were all partly or wholly depleted when the present company, equipped with modern milling, flotation, and smelting facilities, commenced operations in the late 1930's. Production then came mainly from shallow low-grade bodies such as Nababeep South, which is of the disseminated bornite type, and East O'okiep, where the ore is of the chalcopyrite-pyrrhotite variety. Another shallow low-grade body, Carolusberg West, was outlined by diamond drilling during this second phase, but has not yet been mined owing to the discovery, shortly after, of two buried ore bodies at Wheal Julia (high-grade chalcopyrite-bornite), and Narrap (chalcopyrite-pyrrhotite) both of which were situated more conveniently with respect to the existing plants. The discovery of these two bodies, and particularly that of Wheal Julia (since the Narrap body really represented a lower extension of a previously known body that outcropped on surface), introduced what may be regarded as a third phase in the mining history of the district; that, namely, in which production comes mainly from ore bodies that do not extend to the surface (see section). Since the discovery of Wheal Julia, two more bodies of this type have been found, viz., Nababeep West, and Valentine. Shaft sinking has been started at the former, while exploration of the latter is still in progress. Further discoveries are anticipated.



Longhole Blasting From Sublevels For Hard O'okiep Ore With Strong Walls

By E. P. SWANSON J. H. SMYTH and P. C. CAIN

From the mining point of view the country rock in the O'okiep area is generally ideal. The homogeneous country rock stands very well even with vertical walls around a stope excavation. This permits an underground excavation of comparatively large dimensions to be made without having to support the back or walls. When subsidence does occur it is very delayed and accompanied by a small angle of draw. The ore rock is also strong except in the low grade sections of Nababeep mine where it has been weakened by numerous joints and faults which cut it at all angles. None of these rocks are unduly hard or abrasive. They present no unusual problem of drilling or breaking. Rock bursts are unknown and local spalling or slaking is a very rare occurrence.

The country rock is a strong granite or granite gneiss well exposed everywhere on the hills in the vicinity of the mines. These strong walls enclose numerous small isolated basic bodies of highly irregular shape which extend several thousand feet in depth.

In some of these basic bodies is found the copper ore. Its occurrence follows no specific pattern, nor is it confined to any common horizon. The ore zone varies in size also, anywhere from 500,000 to 6,000,000 tons. Generally, there is a high grade portion of sometimes massive copper minerals accompanied by blocks of lower grade rock in which the copper minerals are highly disseminated.

The main copper minerals are bornite and chalcopyrite, usually occurring together in varying proportions. Sometimes chalcocite is found associated with the bornite. In the higher grade zone these minerals sometimes penetrate for a foot or so into the wall of the country rock, but largely there is a well defined contact. The low grade sections with highly disseminated gradational values have ill defined walls and often enclose blocks of granite gneiss. Sections of ore limits are defined by sampling.

Early Mining

During the production period preceding 1937 mining was conducted by

E. P. SWANSON
Superintendent of Mines

P. C. CAIN
Mine Superintendent—Nababeep

J. H. SMYTH
Mine Superintendent—O'okiep

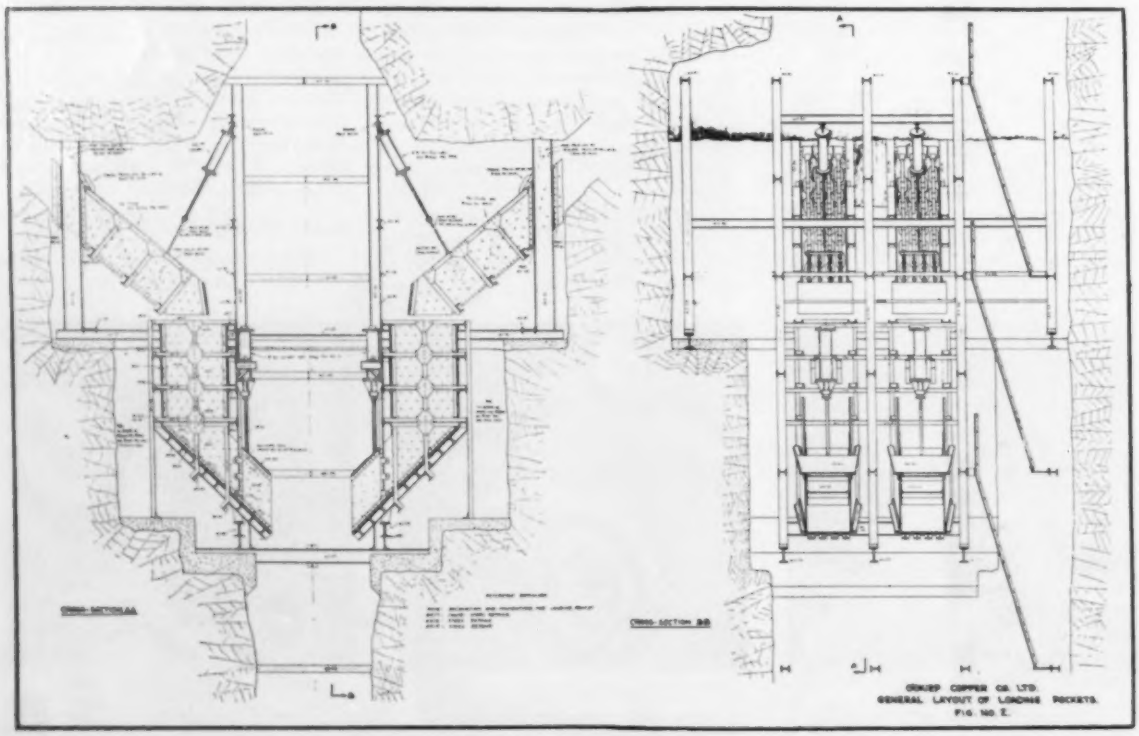
WHEAL JULIA (CONCORDIA) headframe and surface plant. The shaft is 1,200 feet deep. From 20,000 to 25,000 tons of ore per month is hoisted through the shaft in 5-ton skips and trucked to the O'okiep flotation mill.

Cornish miners brought in as specialists. As in many other mining camps of the world, they left their stamp of able craftsmanship in the mines depleted of high grade ore. Their scope of operation was limited by the mining tools at their command and this confined them to sinking on known outcrops and exploiting the ore as it was exposed. The original exploration openings were also used for extraction and never advanced far beyond the stope face. The stoping was largely underhand work leaving pillars to protect the workers out in the stope. Considerable ingenuity and good judgement were exercised to leave low grade portions as support. Vertical pillars were not continuous but were often undercut, leaving a suitable horizontal pillar, the final effect being that of a honeycomb. Following the usual practice pillar support was augmented where necessary with rock packs, timber and masonry retaining walls. When the old mines were reopened the back and walls were found intact although supported by a mere skeleton of pillars, mute testimony of the skill and craftsmanship of these miners of another generation.

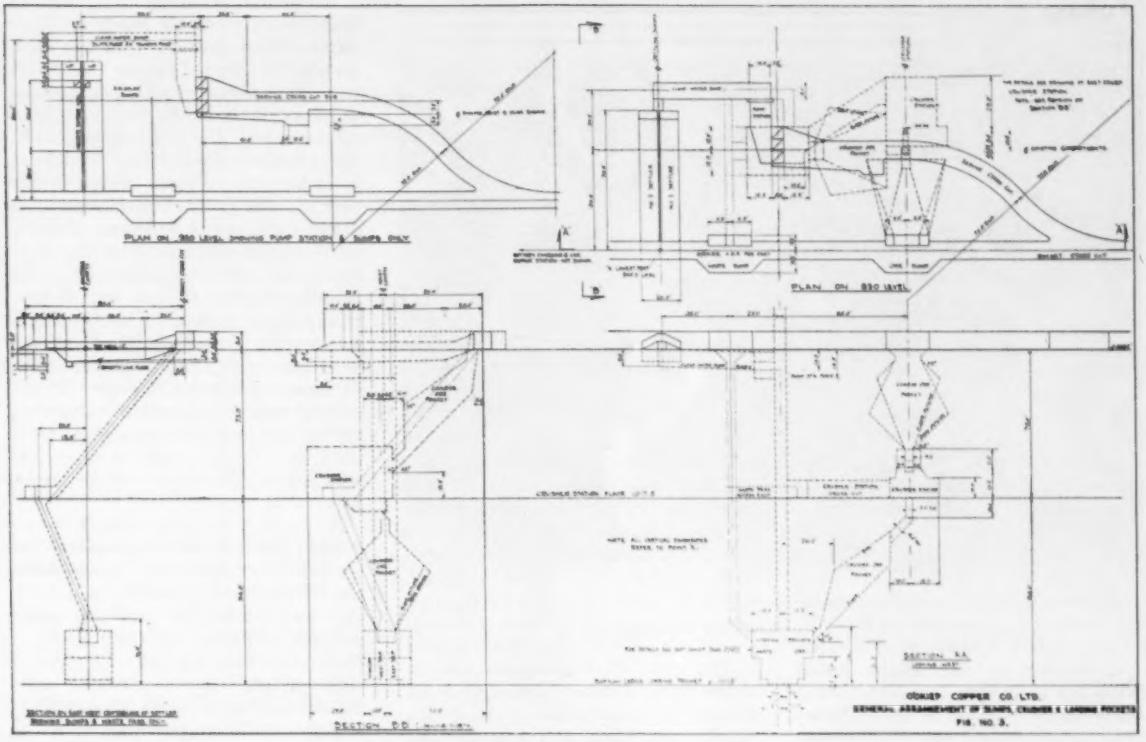
Present Mining

The production from the various mines is regulated to keep the smelter output at capacity. Since they are scattered over a wide area, it was necessary to divide them into two sections each producing about 50,000 tons a month. These are the Nababeep area section and the O'okiep area section. Each is operated by a mine superintendent with the normal mine staff and responsible to a superintendent of mines.

In the interests of low mining costs and efficiency, the general mining practice and equipment are standardized although the standard is sometimes modified to suit the requirements of an individual ore body. (See Figure No. 1.) However, the standard features would be recognized in any one of the mines. The ore bodies are shallow. Those now producing are less than 1,000 feet deep and contain in



O'OKIEP COPPER CO. LTD.
GENERAL LAYOUT OF LONDINE POCKETS.
FIG. NO. 2.



the order of 3,500,000 tons of copper ore each.

Shafts

It is usual to sink two vertical shafts for each ore body, a main shaft to 200 feet below the ore and a ventilation shaft to the elevation of the main haulage level. Both shafts are rectangular with compartments 5 by 5 feet inside. The number of compartments is variable. All sets are 6 by 6 inch steel I beam of 25 pound section and are now put in at eight-foot centers. Blocking is done with 10 by 10 inch Canadian pine. Australian Karri wood guides are bought in 24-foot lengths of 4¾ by 8¾ inch section and finished to 4 by 8 inch in the mine carpenter shop. Broken rock is hoisted in Kimberley type skips with a pay load of three or four tons except at Wheal Julia where bottom dump skips were successfully inaugurated. At all mines rock is hoisted from a single point usually with the ore loading pockets on one side of the shaft and waste loading pockets on the other. (Figure No. 2.) Ore is crushed to minus-6-inches or smaller in the single 36 by 48 inch jaw crusher located underground near the shaft and below the main haulage so that broken rock gravitates finally to the measuring hoppers. (Figure No. 3.) Below these is a hinged baffle and a spillage pocket. A No. 7 Cameron air pump discharges drain water from the bottom to the pumping station on the main haulage.

Main Haulages

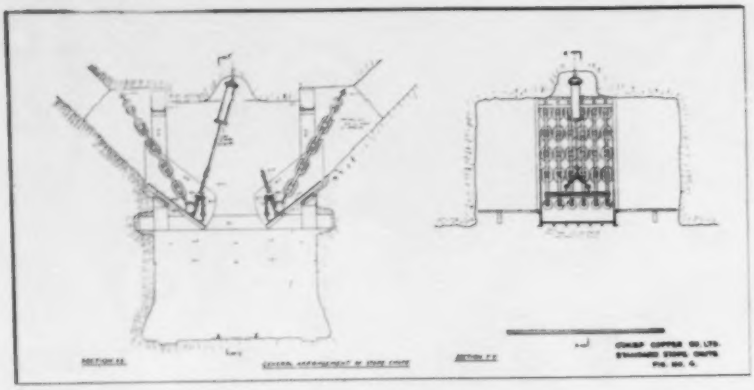
In elevation this level is positioned from 50 to 100 feet below the bottom of the ore body and extends the full length between the shafts with the necessary cross cuts and loops for gathering from isolated sections. Additional haulage ways are put in as required but all ore is transferred to the single crusher. Main haulage ways are driven 8 by 9 feet in section with a 0.5 percent grade in favor of load and equipped with 45 pound rail at 30 inch gauge. Ore is transported in 4-ton Hudson Granby cars which are loaded from a standard steel chute at the boxholes and ore passes. (Figure No. 4.) This has an air operated control of the ball and chain type having six 9-foot lengths of 10-inch pitch chain with an 8-inch diameter ball on each. At the coarse ore dump is a retractible ramp for tipping the cars. The mine cars are pulled by a 4-ton battery locomotive with cells of the lead-acid type driving two 11-horse power motors.

Raises

From this level the sublevels and grizzleys are serviced through a 6- by 8-foot inclined service raise driven in ore, either in a transverse pillar or near the end of the ore body to the upper sublevel. It is equipped with a regulation manway with wooden ladders, used mill screen landings, and a plank service slide. Material is handled in a sliding bucket, and hoisted with a light air tugger. The 6- by 6-foot boxhole raises from the haulage to scram or grizzley level are driven at a minimum angle of 50°. Finger raises connect each with several grizzleys, the top 10 feet being vertical to provide a strong shoulder. Ore pass raises are similar but are driven between haulage ways to transfer ore to the single skip loading pocket.

Grizzley and Scram Levels

Secondary breaking is done on grizzley and scram levels 35 feet below the sill elevation of the ore. Grizzleys now in use have two openings, each 4½ by 1½ feet, with a double center bar and an 18-inch walk on each side. (Figure No. 5.) Grizzley bars are 7 by 10 by 6 inch steel I beam of 40-pound section with a reinforced web. A 7-foot by 1¼- by 7-inch manganese wear plate protects each bar. For protection from the effects of blastings pipe lines are laid on the ground and water blast spray is ap-



plied through rock drill holes from the drift. All grizzleys are equipped with warning whistles which blow during blasting operations. The scram level when required is 6 by 7 feet, usually 150 feet long, and of two types longitudinal or transverse. Each scram has several draw points, and ore is scraped into a boxhole raise covered by a standard grizzley. Slusher hoists in use are all double drum electrically driven and vary from 20 to 75 horsepower in size. These hoists pull Eimco folding scoops of suitable size, 42, 48 or 60 inches. A few Amsco box type scoops of 48- and 60-inch size are being tested.

Sub Level Drifts

The long blast holes for primary breaking are drilled from the 5- by 7-foot sublevel drifts in the ore. At vertical intervals of from 30 to 50 feet these drifts are driven at 0.005 percent up grade from the service raise to the cut out raise. The upper sublevel is carried on to the ventilation shaft and provides an outlet for exhaust air from the stope as mining progresses. In wide ore sections twin contact sublevels are required but often a single one in the center suffices. The blast holes are drilled from 25 to 50 feet long. Both ring drilling and trail and bench methods are in use. In the former the drift must be slashed to accommodate the eight foot extension rods, but the trail can be initially cut to the correct size. Usually several machines drill simultaneously, and air and water manifolds are installed.

Cut Out Raises

The first stope drilling is done at the cut out raises. These are put in 6 by 6 feet in ore at the end of the ore body from the sill level above the last draw point to the top sublevel and connects with each one. Usually they are at the sidewall contacts. Long blast holes are drilled between them from each level and a slot blasted out of the full cross section of the ore at this point. Stopes are then retreated longitudinally away from this slot toward the service raise.

Mine Operation

The mine superintendents are assisted by an overseer in charge of operations at each mine. A mine surveyor, a geologist, and a safety and ventilation officer work in conjunction with both sections. The greater proportion of the European labor force is made up of men from Namaqualand, trained on the job by the supervisor and later by the experienced miners. The non-European group is mostly native. Many in the past came from as far away as Nyasaland and Tanganyika on their own initiative, but they are now being replaced by Union of South Africa natives. No natives are contracted.

All the work necessary for primary breaking is done on day shift. The miner supervises native drill crews on adjacent levels. For drilling sectional steel holes each crew consists of two natives, and they drill 25 to 30 feet of hole each shift. All stope blasting is done electrically from surface when the mine has been cleared of all workmen. These blasts each break in the order of 10,000 tons, using 1.5 to 2.0 tons of explosive which is detonated by millisecond delay blasting caps connected in series of 20 in parallel. The number of holes is variable being adapted to the nature of the ground and available open faces. For these blasts some 60 percent 1¼ by 8 inch gelignite is used for primers and wet holes but 40 percent or 60 percent 1¼ by 8 inch dynamite is the main explosive. When charging and connecting up the work is carried on continuously by relays of miners until the work is completed.

Secondary breaking is conducted continuously over 24 hours on three shifts. Two natives work at each grizzley or scram. Safety chains are worn by everyone working around the grizzleys. Steel hooks, bars and hammers are provided for handling rock. Special safety planks are kept adjacent to each grizzley for use when working over it. All grizzley maintenance is done by the mine timberman. Blasting on the grizzleys is done on the hour every hour. Re-entry is after is 15 minutes. Blasting is done with 40 percent Ammon Dynamite 1¼- by 8-inch or 1- by 4-inch using Nobel safety fuse in lengths up to 24 feet, capped with a 6D Briska aluminum detonator. In the scram levels, mud blasting is done but on the grizzleys rocks are drilled. Output from a single grizzley is about 200 tons per day and from a single scram 180.

To replace the ore bodies being mined others must be prepared for production continuously. This requires the lateral development of main haulages and smaller drifts besides raises and shafts. The 8- by 9-foot haulageways are driven on two shifts a day with a single miner supervising drilling and lashing on each. The round is drilled using four rock drills in about two hours with one native operating each drill. Loading is now done with an Eimco 12B loader operated by a native. Each shift completes the cycle to advance the face about five feet. Blasting is with standard electric detonators in charges from 0 to 10 and 60 percent 1¼- by 8-inch gelignite. The advance per month is 250 feet.

Rock Drill Equipment

All rock drill repairs and rock drill steel sharpening required for the mines are done on surface in the fully equipped modern shop. The work is in the charge of local Europeans trained on job. Each month they sharpen and temper 10,000 pieces of drill steel, regrind 1,500 tungsten carbide bits, treat, thread and normalize 1,200 sectional steel rods and bit ends. Also maintenance to keep the 280 rock drills in use. All rock drilling is done with tungsten carbide tipped steel with a chisel type bit, except that holes are collared with a three foot steel having a standard 1¾-inch gauge crossbit head, and block holes are drilled with a 24-inch steel with a 1¾-inch bit. For development work the drill steel is ⅞-inch hexagonal with 18-inch changes from 54 to 90 inches long with 38 mm. and 40 mm. gauges to follow. For shaft sinking a 36-inch steel of 40 mm. gauge is followed by one 72-inch and 38 mm. gauge. On the grizzleys stand-

ard steel is supplemented with worn tungsten carbide tipped steel with the stems cut to 24 inches. The long blast holes are drilled with one-inch quarter octagon alloy drill steel with a 44 mm. gauge tungsten carbide bit in a 24-inch threaded stem. There are four shanks in two foot changes from two to eight feet with an eight-foot extension rod. The coupling is a No. 2 jack rod type, 2½ inches long with an outside diameter of 1¾ inches. From each end is cut an internal reverse buttress thread. The coupling is ¾-inch smaller than the bit and as it wears faster it can be used again with a used bit. However, when the bit is worn to coupling size it is used with a smaller 1½-inch diameter coupling.

Nababeep Mine

In addition to the standard features described above each mine has its notable characteristics. In the Nababeep area the total production of copper ore comes from a single mine, the Nababeep mine. From it a haulage level is being driven 6,000 feet to the northeast to the unmined Valentine ore body. Two miles to the west is the Nababeep West orebody where shafts are now being sunk. The Nababeep Flat mine and Nababeep North mine which augmented Nababeep production until this year have been depleted. In this area is also included the Nababeep tungsten mines which are now supplying 200 tons of tungsten ore a day from scattered workings.

The ore body of the Nababeep mine can best be described as a shallow cluster of low grade mineralized bodies grouped around a higher grade core. This core originally outcropped and 1,250,000 tons of oxide capping has removed to expose the sulphide ore below. The walls around this are very strong with a well defined contact. In the low grade bodies the contact is often vague and sampling determines the economic limit. In both types the ore minerals are bornite and chalcopyrite in that order of importance.

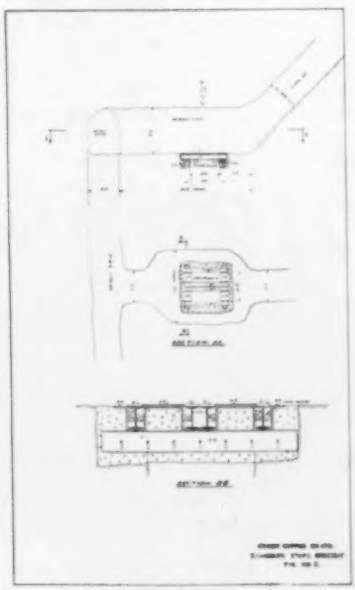
The core and the low grade bodies are mined as separate subsections, the core being known as the South Section and the others as the East Section, and the North East Section. The ore from all sections is hoisted up the Nababeep main shaft. This is a 17 by 7 foot vertical shaft 707 feet deep with two 5 by 5 foot hoisting compartments and a 4 by 5 foot manway and pipe compartment. Two 4-ton Kimberley type skips largely of aluminum construction are in use. These dump into a 2,000 ton bin located beside the

NABABEEP MINE and town of Nababeep. The large dump at left center is from early surface workings. At Nababeep a high grade core is mined separately from lower grade ore bodies surrounding the core. All ore is hoisted through 707 foot deep shaft.

78 foot headframe but below the shaft color elevation. In a general way the mine is serviced through various levels by a 45° 10- by 6-foot incline shaft extending from surface to the main haulage level. In addition the two subsections have internal separate service raises.

All ore is trammed on the 546 level where 8,800 feet of haulage links the present operating sections and the old North mine to the main shaft. Traffic is controlled by a section isolating signal light system.

The south section was one of the original mines and in 1937 when acquired was a labyrinth of workings comprising 6,000,000 tons of 2.5 per cent copper ore mostly in remnants and pillars. Originally its dimensions were 800 feet north-south, 400 feet wide and 500 feet deep. While the oxide outcrop was being quarried into adit draw points, the sulphide ore body was being developed and a grizzley system installed on the 450 and 506 levels. Production was started in the south end with a cut out the full width of the ore and stoping was carried on by retreating to the north. Production was augmented with ore from spiral stopes in select locations. Eventually the stope width was great and the back opened through to daylight. Stoping continued and periodically falls of ore would occur often followed by overhanging waste from the walls. The falls were all expected and persons cleared from the mine. The most recent one occurred in the morning of December 8, 1953, the mine being cleared on December 7 at 3 P.M. and restarted on the afternoon shift of the 8th. During this period 1,700,000 tons of rock fell over the fully prepared footwall extraction system leaving the present huge open pit with its 400 foot walls. Fifty percent of the remaining ore in pillars and remnants will be extracted undiluted. When further caving occurs extraction will be continued to the economic limit of the ore with a controlled draw. Before it is concentrated this rock will be up graded in the heavy media separation plant.



The low grade sections were prepared for large scale efficient sub-

O'okiep Mining

O'OKIEP SHAFT in center background. In immediate foreground is the sulphuric acid plant (left) and the power plant. The flotation mill is between the acid plant and mill. O'okiep mine ore is very strong so vertical stope faces are carried.

level stoping and so equipped. The North East Section lies 100 feet from the main shaft and strikes 300 feet to the east. With a maximum width of 160 feet at the east end it extends from 85 level to the 606 level with dips to the south varying from 60° to vertical and back to 40°. The ore is very weak being cut by faults, slips, and mud seams running in all directions. The portion above 506 level which is the grizzley level is now being stoped. Sublevels are at 30 foot vertical intervals and from these radiating rings of holes are drilled every five feet with the holes inclined from horizontal up to vertical and not more than 40 feet long. In this fractured ground it is not possible to drill long down holes without a diamond drill. In the interests of low costs no diamond drilling is done at Nababeep mine. A safety feature of these stopes is that since the ground is too weak to stand with a vertical or overhung face it is carried with a reverse face. This way the danger of a section falling away is minimized. When blasting is done on a lower sublevel it weakens the ground above so that the whole stope face must be blasted at once. In spite of these precautions secondary breaking is a problem since large blocks of ore are torn away with the blast, or fall afterwards before the stope face assumes a new stable outline. 17,000 to 20,000 tons of ore are produced each month through the 506 level grizzleys and scrams.

The other low grade section, the East Section, starts 400 feet south of the main shaft and extends 400 feet to the east. Its average width is 150 feet and extends from 193 to 330 level. This ore is weaker than that of the previous section and the same drilling and mining precautions are observed. The secondary breaking is done entirely in scram levels on the 362 level. These are equipped with 75 horse power slushers. In all there are five transverse scrams with 17 drawpoints laid out for this block. Production is from 10,000 to 12,000 tons per month.

The Nababeep mine, which is the largest single mine operated by this company, is producing 54,000 to 56,000 tons of ore per month. Of this the South Section supplies 50 percent, Northeast Section 30 percent and the East Section 20 percent. The total underground labor force consists of 40 Europeans and 280 non-Europeans. Tungsten carbide tipped steel lasts well in Nababeep rock. It is usual to drill 250 feet with a development steel and 325 feet with a sectional steel before finally discarding it.

O'okiep Area

There are two producing mines in the O'okiep area, the O'okiep mine and the Wheal Julia mine six miles to the north. The main producing subsection of the O'okiep mine is East O'okiep with West O'okiep and Narrap now under further development.

East O'okiep Mine

The East O'okiep orebody is 3,500 feet long, and sausage-like in shape, having a very irregular outline. Although in places only 200 feet from the surface, it does not outcrop. The minerals are chalcopyrite and pyrrhotite which is important for the production of sulphuric acid at the property. The ore body was divided up into 400 foot longitudinal stopes separated by 50 foot transverse pillars. Several of these stopes are operated simultaneously for maximum production. In this mine the ore is very strong and stope faces carried vertical or overhanging. All long blast holes are drilled below the horizontal with hand-held machines, both trail and bench, and pattern ring drilling being used. Secondary breaking is done entirely by mud blasting in longitudinal or transverse scram levels. Dynamite consumption is 0.62 pounds per ton of ore.

Wheal Julia

At Wheal Julia, also, the ore does not outcrop but is a deeper dike-like body extending from 200 feet to 900 feet below the surface with a maximum width of 150 feet. It dips to the north from 45° to vertical with a strike length of 750 feet. The main mineral of the high grade ore is chalcopyrite although some bornite is found.

The skips in use are of the bottom dump type integrated with the man cage. The cage is above and the floor folds up when loading ore. Shaft timbering is unusual. Instead of full sets 6 by 5 inch steel dividers of 25 pound section with the web horizontal were cemented into box hitches cut in the strong wall rock with five feet between. Contrary to the usual practice the upper levels of this mine were developed while sinking was still in progress. Development rock was hoisted in the tightly bratticed east compartment while the center one was used for sinking.

Stoping conditions generally resemble O'okiep since the ore is very strong. However, here blast holes are drilled above and below the horizontal as required and all secondary breaking is done on grizzleys.

The mine is operated on only two shifts per day to produce 25,000 tons of ore per month which is the present quota.

Tungsten Mining Operations

As mentioned above the company is mining and milling some 200 tons per day of tungsten ore, averaging 0.50 percent WO_3. The ore is derived from several moderately sized wolframite-bearing occurences on the property. Concentrates are being sold under contract to the United States government.

NABABEEP MILL is built adjacent to Nababeep shaft (upper right). Ore from shaft bin is conveyed directly to mill bins. At far left is the tailing dam and pond. Smelter is large building in center. Gases go through tunnel and out high stack.

Make The Mill Fit The Minerals: Flotation, HMS, and Leaching

By F. J. MARTIN, D. P. BRITTS, and C. H. DeBEER

The company has two 1900-ton-per-day copper concentrators, one at Nababeep and the other at O'okiep, some nine miles distant by road. Ores are treated not only from the main Nababeep and East O'okiep mines, but also from several smaller workings in the vicinity, Wheal Julia supplying at the present time about half the tonnage treated at the O'okiep mill.

At Nababeep a 500-ton tank leaching plant is treating a 1,000,000-ton oxide dump. This dump consists of the oxidized capping originally stripped from the site of the glory hole. It is planned later to treat other dumps and oxide ores in the vicinity using the same plant. In addition, dumps are being treated by heap leaching at O'okiep and at Spektakel some 26 miles distant.

In the Nababeep mine there is a large, lower grade section of ore which contains inclusions of barren gneiss in the copper-bearing norite. Test work showed this ore to be amenable to beneficiation by the sink-float method at a size of minus-6-inch, plus-¾-inch. A heavy media separation plant to treat 75 tons per hour started operations at the end of 1954.

A research and ore testing laboratory is maintained to check on and improve operating results, and to investigate various types of ores, new treatment methods, and reagents.

Primary Crushing

At each of the major operating mines—Nababeep, East O'okiep and Wheal Julia—a 36 by 48 inch Birdsboro-Buchanan jaw crusher is in-

F. J. MARTIN
Superintendent of Mills

D. P. BRITTS
O'okiep Mill Superintendent

C. H. De BEER
Nababeep Mill Superintendent

stalled underground. A fourth similar crusher is soon to be installed in the Nababeep West mine. The Nababeep crusher is fed by means of a Ross chain feeder and the others with ball and chain gates operated with air cylinders. The crusher is set at 5½ inches at Nababeep and 4¾ inches at the other two mines where the ore is softer and the tonnage lower.

Nababeep Mill

The Nababeep mill started in April 1940; as of the end of June 1954, it treated 7,887,000 tons of ore and produced, in concentrate, 166,700 tons of copper. Most of the ore treated was from the Nababeep mine, but ores from the North mine, Flat mine, West O'okiep, and Wheal Julia mines were also treated at times. The Valentine and West Nababeep mines will come into production later and these ores will be sent to the Nababeep mill.

The ore from the Nababeep mine assays from 1.50 to 2.50 percent total copper and consists of bornite as the predominating copper mineral fairly coarsely disseminated in a gangue of norite. There are smaller amounts of brochantite, chrysocolla, and malachite, the "oxide" copper content varying between 0.2 and 0.6 percent.

Flotation Facts

The bornite gives little difficulty in flotation. At a grind of 60 percent minus-200-mesh it cleans up fast with a sulphide copper recovery of 95 to 96 percent. The recovery of the non-sulphite ("oxide") copper is difficult and varies from 25 to 50 percent. A concentrate grade of 40 percent copper is maintained, giving a ratio of concentration of about 20 to 1. A lower grade concentrate gives trouble in the reverberatory furnace.

In the grinding circuit considerable oxidation takes place and oxide copper in the flotation feed may run twice as high as in the mill heads. This oxidation is controlled to some extent by adding sufficient lime to the ball mills to give pH 10 in the ball mill discharge.

It is found that the best flotation results are obtained by carrying a high circulating load in the rougher-cleaner circuits with a pH of 9.5 in the roughers and 11.5 to 12.0 in the cleaners. Leeds and Northrup 8-point pH automatic recorders are used to help control the alkalinity. No improvement in results has been found when treating a Nababeep ore by conditioning the pulp prior to flotation or by regrinding the cleaner tailing. The copper recovery varies according to the different ores being treated in the mill. The sulphide copper recovery varies from 93 to 96 percent and the total copper recovery from 85 to 92 percent.

The flotation reagents used are sodium isoropyl xanthate as collector and either pine oil or cresylic acid as frother. These reagents are stage-fed to the rougher flotation circuit. Lime is used to regulate the alkalinity and is added to the four ball mills where it also reduces oxidation. Additional lime is added to the cleaners.

Crushing Hard Ore

The ore, after primary crushing underground, is hoisted in 4½-ton skips to a 1,000-ton surface bin, the top of which is level with the shaft collar. The crushing plant is actually underground, about 60 feet below the shaft collar, and is serviced through a 250-foot tunnel.

From this coarse ore bin, the ore is fed by means of a 6- by 6-foot roll feeder and a 36-inch belt conveyor to a 5½-foot Symons standard cone crusher set at ¾ inch. A 5- by 8-foot Allis Chalmers Lowhead screen protects this crusher from fines. The minus-1-inch portion of the crusher feed bypasses the crusher and drops to the crusher discharge belt conveyor. The Standard cone crusher is in open circuit. The crushed ore is conveyed to three 5- by 8-foot A-C., Lowhead, single-deck screens in parallel, fitted with 5/16 by 1-inch opening cloth. The screen oversize feeds a 5½-foot Symons Shorthead cone crusher set at 5/16 to ¾-inch This crusher is in closed circuit with the screens. The discharges from both cone crushers and the scalping screen are transported by means of the same belt conveyors, 42 inches under the crushers, and 36 inches wide up to the screens. The finished product from the screens is transported to a 5,000-ton mill bin on 30-inch belt conveyors. The ore is distributed in the bin by means of a manually operated tripper.

The crushing rate is 110 tons per hour. The ore is hard and tough. The crushers operate three shifts, six days per week, with time taken on day shift for regular repairs. Each cone crusher is protected from tramp iron by a magnet. A 10-ton travelling air hoist is used to service the crushers and screens.

Grind In Marcys

The grinding section consists of four 8- by 8-foot Marcy grate-type ball mills, each in closed circuit with an 8- by 27-foot Dorr Multizone classifier. The ball mills are driven by 350-horsepower, 292 revolutions per minute slipring motors connected to the pinion shafts through Gearflex couplings. The motors are operated at full load. The ball mills are run at 20.5 revolutions per minute. The ball charge is maintained with daily additions of 3½-inch cast iron balls.

The feed to the mills is regulated by means of Hardinge constant weight feeders. The mills are fitted with discharge trommel screens with half-inch holes to keep small balls out of the classifiers and scoop boxes. The classifier overflows, at 35 percent solids, pass directly to flotation without conditioning. The grinding is in single stage with the fineness of grind 5 percent plus-65-mesh and 60 percent minus-200-mesh.

Reclean Bulk Concentrate

The flotation section is 10 feet below the grinding floor. The roughing section consists of two parallel banks of eight 66-inch Fagergren machines followed by two 20-foot modified Southwestern pneumatic cells operating in series and acting as scavengers. The Fagergren cells are run at 485 revolutions per minute. The rotors and stators are rubber-covered. Air is supplied to the pneumatic machines at a pressure of 2 pounds by a 5,000-cubic-foot-per-minute Sturtevant blower.

The bulk rougher concentrate from the Fagergren and pneumatic machines is laundered to a central sump where lime is added to increase the alkalinity for cleaning. The pulp is pumped with a 5 by 4-inch SRL-C sand pump to the cleaner section which is located on the grinding floor level.

The cleaner section consists of two 3-cell No. 24 Denver units operated in series. A third 3-cell unit is available for use as a recleaner when the mill heads are below average. The Denver cells are operated at 300 revolutions per minute. Both conical and receded disc impellers are used with similar results.

A final concentrate is removed from the cleaner cells and the cleaner tailing is laundered directly to the distributor at the head of the roughers without regrinding. The final concentrate flows by gravity to a 40 foot Dorr thickener and the thickened pulp is pumped to a 11.5 by 14-foot Oliver filter. The filter is covered with 32 ounces twill. The filter cake, containing 12 percent moisture, is transported on an 18-inch belt conveyor to the smelter stock floor.

The flotation tailing flows by gravity to a 90-foot Door thickener. The underflow at 50 percent solids is pumped in three stages by 6-inch Wilfley sand pumps to the tailing dam. Water is returned from the thickener and the tailing dam.

O'okiep Mill

The O'okiep mill started in April 1945 and to the end of June 1954 it treated 3,550,000 tons of ore and produced, in concentrates, 76,950 tons of copper. Most of the ore treated was from the East O'okiep and Narrap mines, but ores from the West O'okiep and Wheal Julia mines have also been milled at O'okiep since the plant was expanded in 1953.

The East O'okiep ore, after primary crushing underground, is hoisted to a 500-ton surface bin. The Wheal Julia ore, also after primary crushing, is transported by means of 30-ton tractor-trailer units some seven miles to the O'okiep crushing plant where it is dumped into a surge bin and conveyed to a 500-ton bin alongside the East O'okiep coarse bin. The West O'okiep ore, after primary crushing on surface, is transported one mile to the O'okiep crushing plant and mixed with the Wheal Julia ore. The East O'okiep and Narrap ores are mixed underground; this mixture and the mixture of Wheal Julia and West O'okiep ores are crushed separately.

The ore from the East O'okiep mine assays from 2.0 to 2.5 percent copper. The copper mineral is chalcopyrite which is found in diorite with some quartzite. A varying amount of pyrrhotite averaging about 15 percent is present, generally disseminated but also massive. There are no oxidized copper minerals. The Wheal Julia ore averages about 4.5 percent copper and contains a mixture of bornite and chalcopyrite in a gangue of hypersthese diorite. The West O'okiep ore contains bornite and chalcopyrite in a diorite gangue, and runs about 5.0 percent copper.

Metallurgical Characteristics

In the treatment of the East O'okiep ore, the chalcopyrite is liberated quite thoroughly from the gangue at a grind of 70 percent minus-200-mesh but there is some attachment of pyrrhotite. The cleaner tailing is reground. A copper recovery of 94 percent is maintained with a concentrate grade of 20 percent copper and a ratio of concentration of 10 to 1. A lower grade of concentrate gives trouble in the smelter by reducing the grade of matte and increasing the nickel content of the blister copper due to small amounts of pentlandite associated with the pyrrhotite. The Wheal Julia and West O'okiep ores float well with recoveries of 96 to 97 percent of the copper and a concentrate grade of 30 to 33 percent copper depending on the proportion of bornite to chalcopyrite.

The flotation reagents used in the copper circuits are Aerofloat 238 promoter and cresylic acid, added to the conditioners and stage-fed to the rougher cells. A small amount of cyanide is fed to the East O'okiep circuit. Lime is used for alkalinity control and is added to the ball mills to give a pH of 9.5 in the rougher circuits. Additional lime is added to the cleaners to give pH 10.5 to 11.

In the pyrrhotite circuit the East O'okiep copper tailing is acidified with sulphuric acid to pH 6.5. Aero Xanthate 301 is used as the promoter and cresylic acid as frother. A grade of 30 percent sulphur gives the best operation in the acid plant and this is easily maintained.

Two Stage Crushing At Mill

The ore from the two coarse bins is fed by means of adjustable finger chutes and a variable speed 36-inch belt conveyor to a 4¼-foot Symons standard cone crusher set at ¾-inch in open circuit. A 5- by 10-foot AC. Lowhead screen protects the crusher from fines. The screen is double deck and is fitted with 2-inch punched plate on the top deck and ¾-inch square opening on the bottom deck. The screen undersize joins the final product from the finishing screens. The large opening on the scalping screen is due to the high moisture content in the ore.

The product from the standard cone is transported by 36-inch belt conveyors to two 5- by 10-foot AC. Lowhead screens in parallel. The screens are fitted with either ¾- by ¾-inch or $^{5}/_{16}$- by 1-inch opening screen cloth, the coarser cloth being required for wet ore. The oversize from the screens feeds a 4-foot Symons Shorthead cone crusher set at ¾ to $^{5}/_{16}$ inch. This crusher operates in closed circuit with the screens. The finished product from the screens is conveyed to two 3,000-ton fine ore bins, one for East O'okiep and Narrap ore, and the other for Wheal Julia and West O'okiep ore.

The crushing rate is 110 tons per hour. The crushers operate three shifts, six days per week, with time taken on day shift for regular repairs. A magnet removes tramp iron ahead of the cone crushers.

One Or Two Stage Grinding

In the O'okiep mill grinding section there are three 9- by 10-foot Head Wrightson ball mills. The original mill employed single-stage grinding with two ball mills each in closed circuit with a 10- by 30-foot Door DSFX classifier. When the mill capacity was increased 50 percent in 1953, a third 9- by 10-foot ball mill was installed to operate in closed circuit with a 16- by 37.5- by 22-foot

NABABEEP FLOTATION MILL shown at top left treats 1,900 tons of bornite ore daily. This ore is mined at the nearby Nababeep mine and averages 1.5 to 2.5 percent copper. Concentrate grade is set at 40 percent to facilitate smelting.

bowl Door QSFXB classifier as a secondary grinding unit. The grinding circuit is now arranged to operate No. 1 of the two original ball mills alone as a single-stage unit and Nos. 2 and 3 ball mills as a two-stage unit. This was found to be necessary because mixing the East O'okiep and Wheal Julia ores gives trouble in the flotation circuit. The No. 1 ball mill can also be used as a primary ball mill in parallel with No. 2 ball mill, when treating one kind of ore in the plant.

The two primary ball mills are driven by 450-horsepower, 730 revolutions per minute slip ring motors through David Brown helical gear speed reducers. The ball mills originally operated at 17.65 revolutions per minute as overflow type mills, then grates were installed to increase the tonnage. When two-stage grinding was adopted, the grates were removed and the speed increased to 20.4 revolutions per minute. This arrangement is more satisfactory as there is a reduction in lost time and the ball mill operation is simplified. The ball charge is maintained with daily additions of cast iron balls, 3 inch for single stage grinding and 3½ for primary grinding.

The No. 3 ball mill, used for secondary grinding, is driven by a 500-horsepower, 300 revolutions per minute synchronous motor which operates at 0.80 leading power factor, connected directly through a Wellman-Bibby coupling. The ball mill operates at 18.2 revolutions per minute. The ball charge is maintained with daily additions of 2-inch forged steel balls.

Two Flotation Circuits

The copper flotation section has four parallel rougher units and two cleaner units. Three of the rougher units have 12 No. 24 Denver cells each and the fourth unit consists of 12 No. 48 Agitair cells arranged 4-4-4. Each of the cleaner units consists of four No. 48 Agitair cells. The Denver cells operate at 300 feet per minute. The Agitair rougher impellers operate at 1,490 feet per minute and the cleaner impellers at 1,320 feet per minute. Air is supplied to the Agitair machines at a pressure of 2 pounds by a Buffalo steel plate fan. Rubber-covered wearing parts are used.

It is necessary to run two separate flotation circuits for the East O'okiep and the Wheal Julia ores. The East O'okiep ore requires more flotation time. When treating 1,280 tons of East O'okiep ore and 620 tons of Wheal Julia ore per day, the three Denver rougher units and one cleaner unit are used for the East O'okiep flotation and the fourth rougher unit and second cleaner unit are used for the Wheal Julia ore. When treating 620 tons of East O'okiep and 1,280 tons of Wheal Julia ores per day, two of the Denver rougher units and one cleaner unit are used for the East O'okiep flotation.

As at Nababeep mill, the flotation flowsheet is simple. The classifier overflow in each circuit is conditioned in an 8- by 8-foot Denver conditioner and pumped to a pulp distributor for distribution to any of the four rougher flotation banks. In each of the rougher circuits, a bulk rougher concentrate is made and this is pumped to its cleaner unit with a 5- by 5-inch SRL sand pump. The East O'okiep cleaner tailing is reground in a 5- by 5-foot ball mill in closed circuit with a 12-foot hydroclassifier, and then returned to the flotation feed distributor. The Wheal Julia cleaner tailing is returned to the rougher flotation feed without regrinding.

The final concentrates from the two cleaners are pumped together to two 40-foot Dorr thickeners operated in series. The thickened pulp is pumped with 4-inch duplex diaphragm pumps to two 14.5- by 16-foot holding tanks. The concentrate at about 70 percent solids is pumped from the holding tanks as desired to a 14- by 16-foot Oliver filter covered with 32-ounce twill and stainless steel wire. Ordinary plough steel and copperweld wire are not satisfactory, but the stainless steel wire lasts at least four years and is used several times. The concentrate drops from the filter onto an 18-inch belt conveyor and is transported to a 100- by 120-foot drying floor where it is spread by means of scrapers attached to double-drum electric hoists. The concentrate is reduced to 8 percent moisture by air and sun and is then loaded into 30-ton semi-trailer units with the scrapers and hauled to the smelter at Nababeep.

Pyrrhotite Flotation

The tailing from the East O'okiep copper flotation section gravitates to a 5- by 5-foot conditioner where the pulp is acidified. This copper flotation tailing constitutes the feed to the pyrrhotite flotation section where a concentrate is floated for use as the source of sulphur in the sulphuric acid plant. The circuit consists of two parallel units of five No. 24 Denver cells each. In each unit the feed is introduced into the No. 2 cell and the concentrate from the Nos. 2, 3, 4, and 5 cells gravitates back to No. 1 cell which is used as a cleaner. The cleaner tailing passes through to join the feed in No. 2 cell. The pyrrhotite concentrate is thickened to 65 percent solids in a 40-foot Door thickener and filtered by means of a 11.5- by 14-foot Oliver filter, covered with 32 ounce twill and stainless steel wire. The thickener is crowded by recirculation of pulp and addition of extra water and is operated with a dirty overflow to eliminate some of the slime, and thus reduce the moisture content of the filter cake.

The pyrrhotite can be stored in a bin only a few days before starting to burn. For this reason only three days' supply is kept ahead of the acid plant in the filtered concentrate bin, but a two weeks' supply is maintained in concrete bins and kept covered with water for use in emergency should the pyrrhotite-bearing ore be cut off temporarily, or a major repair job or alteration be necessary in the mill.

The flotation tailing from the Wheal Julia and the pyrrhotite circuits both flow by gravity to a 70-foot Dorr thickener. The underflow at 50 percent solids is pumped in three stages by 6-inch SRL-C and Wilfley sand pumps through a 7-inch woodstave pipeline to a second 70-foot Dorr thickener, 2,200 feet distant. The underflow of No. 2 thickener at 57 percent solids flows by gravity in a concrete launder 1,100 feet to the base of a hill; from there it is pumped to an 80-foot Dorr thickener installed on the hill. The underflow from this No. 3 thickener at 68 percent solids flows by gravity to the tailing dam which is being built with the hill forming one side of a large square. Water is returned to the mill from the three thickeners and the collecting pool inside the tailing dam. An effort is made to restrict water loss as nearly as possible to that due to evaporation.

Attempts have been made to mix the East O'okiep and Wheal Julia ores in order to simplify the operation of the mill, but to date this has not been successful. When the two ores are mixed, the activating effect of Wheal Julia ore on the pyrrhotite in the East O'okiep ore is very pronounced. The extra tonnage of pyrrhotite floated when milling the mixed ores not only displaces chalcopyrite in the smelter feed, thus reducing the copper output, but also represents a serious loss of sulphur for acid manufacture.

Copper Leaching

There are two leaching plants in operation, the main one being a 500-

ton per day tank-leaching plant at Nababeep. Leaching of an old tailings dump at Spektakel is nearly completed and treatment of the waste dump left by former operators has been started.

The Nababeep leaching plant started in January, 1951 and up to the end of June, 1954 it treated 352,500 tons of ore and produced 7,905 tons of copper. The ore comes from a dump which consists of the oxidized capping originally stripped from the Nababeep South mine outcrop.

The ore is loaded with a ¾-yard Marion shovel into a 10-ton truck and hauled to a 350-ton coarse ore bin. From the coarse bin the ore is fed into a 24- by 36-inch Birdsboro-Buchanan jaw crusher set at 2½-inches. The crushed material is transported to a 250-ton intermediate bin.

Screen Out Fines

Ore from the intermediate bin is screened at ¾-inch. Undersize is feed for leaching. Oversize is crushed in a Symons 5½-foot Standard shorthead crusher operating in closed circuit with ¾-inch screens. Oversize is returned to the crusher by conveyor and the undersize drops to a fine screen. This screen is double-deck with 9-mesh cloth on top and a steel plate on the bottom deck to collect the undersize. This undersize, minus-$\frac{1}{16}$-inch, amounts to about 5 percent, by weight, of the ore and is stockpiled for future treatment. Oversize is feed for leaching.

Distributor For Tank Loading

The charging of the leaching tanks is most important as there must be no segregation of coarse and fine ore. The charging distributor was designed and fabricated locally and operates very well. The distributor is placed over the tank to be filled and the cone crusher started. The crushed ore is transported by belt conveyor to a hopper situated at the center of the distributor. This conveyor and hopper are supported by a small bridge attached to the main bridge structure. From the central hopper the ore drops onto a reciprocating belt conveyor 12 feet long, which travels to and fro on tracks supported on a turntable. The turntable revolves continuously, about a central vertical axis with the tank being filled, on a circular track 29 feet in diameter. As the turntable rotates the reciprocating conveyor is moved slowly forward and backward, as required, to bed the tank evenly from center to outside and back again.

In order to reduce segregation of fine and coarse particles to a minimum, the leaching tank feed, besides being very carefully charged into the tanks, is agglomerated during charging by spraying water ahead of the distributor. In spite of careful charging accompanied by agglomeration, it is necessary to remove a proportion of the fines amounting to 5 percent of the ore in the crushing plant.

Fir Leach And Solution Tanks

The leaching and solution tanks are of wood stave construction, made of clear, thoroughly seasoned Douglas fir. There are 11 ore leaching tanks 32-feet in diameter by 14-feet high with 3-inch sides and 4-inch bottoms. These tanks have filter bottoms.

Each leaching tank has a corresponding solution tank located on a lower floor. These tanks are 25-feet in diameter by 8-feet high.

A counter-current system of leaching is employed. Eight tanks of ore are being leached at any one time while one is being washed, one unloaded and one loaded. The leaching period is about 18 days, 17 tanks of ore being leached per month.

Thorough washing of the leached charge is essential. After leaching is completed each charge is given six washes with 10,000 gallons water and the wash water is added to the circuit to make up the new acid solution.

The pregnant solution draining from the last tank in the circuit, containing the newest ore, is pumped to two pregnant solution storage tanks from which it is drawn at a uniform rate to the precipitation cells.

Scrap iron is used for precipitation. It must be shaken frequently with hooks and compressed air to dislodge the adhering copper. The precipitated copper is removed from the cells every five to seven days. It is air dried, and hauled to smelter.

Operating Details

An average of 8,500 tons of ore assaying 2.50 percent total copper is treated monthly. The "oxide" copper content is about 2.15 percent and the sulphide copper averages about 0.35 percent. The copper minerals present are brochantite, chrysocolla and malachite, with the sulphide bornite. Approximately 90 percent of the oxide copper and 50 percent of the sulphide copper are extracted, giving an extraction of 84 percent of the total copper.

The consumption of acid amounts to 3.45 pounds of 100 percent sulphuric acid and the consumption of scrap is 1.6 pounds per pound of copper produced. Some of the scrap used is rusty.

Some of the items of equipment which give good service in this plant are mentioned briefly. Duriron pumps and Worthington "Worthite" pumps are both handling solutions well. Carlon E plastic pipe resists the dilute acid solutions successfully, and Nor-Var anticorrosive paint is used throughout the plant on steel and wood. Stainless steel shovels have been used for four years and forks for three years with practically no signs of corrosion.

NABABEEP from the Nababeep mill. In the right foreground are spare parts for the mill, at the right are the warehouse and shop buildings. Housing for European employees in the valley is partially hidden by smelter smoke.

High Grade WO_3 Concentrate From Complex Low-Grade Ore

By D. R. RICHARDSON

In the Nababeep-O'okiep district there are several tungsten deposits some of which were worked during and just after World War II. The old milling plants have all been dismantled. In 1953 a modern 200-ton per day gravity mill was built near Nababeep to treat ores from the several deposits, as well as the tailings dumps left by former operators. With the more efficient new plant it is possible to effect a substantial recovery of tungsten from these dumps.

The ore from the tungsten mines assays from 0.25 to 1.00 percent WO_3, and consists of wolframite as the tungsten mineral in quartz enriched lenses in schist and granulite. The gangue minerals are principally quartz, garnet, sillimanite and biotite. Both ore and old tailings have been treated from a number of workings in the vicinity and from an ore dressing standpoint the various occurrences do not differ materially, the same flowsheet lending itself to the treatment of all ores yet encountered. The main differences noted are in the fineness of dissemination of the wolframite and in the content of impurities such as bismuth, copper, phosphorous, and sulphur. In all cases the wolframite is substantially freed at 35 mesh size but with the different ores the proportions of the tungsten recovered in the jigs and on the tables vary.

Crushing

The crushing plant and mill were built close to the Nababeep Near West mine. The ore from this mine is trammed with a battery motor from the haulage adit on the side of a hill to a 300-ton coarse ore bin above the crushing plant. The ores from the other workings: Far West, East, and Tweedam mines are hauled with trucks.

From the coarse bin the ore is carried by a 24-inch belt conveyor to a 24 by 12-inch Allis-Chalmers Blake crusher set at 2-inch. The crushed ore drops onto a 30-inch picking belt and is transported at 50 feet per minute to an 18-inch belt conveyor running at right angles. When treating tailings from the old dumps, the material is drawn from the 1,000-ton bin and carried by a 24-inch belt conveyor through to the 18-inch belt conveyor, thus bypassing the jaw crusher. This belt conveyor transports the ore, or tailings to a 5 by 10 foot single- deck Allis-Chalmers Lowhead screen fitted with $^3/_{16}$-inch square opening screen cloth. The vibrating screen is large to ensure elimination of all minus-$^3/_{16}$-inch product and also because the ore is sometimes wet and sticky. The screen oversize feeds a 2-foot Symons standard cone crusher (fine bowl) set at $^3/_{16}$ to $^1/_4$-inch. The cone crusher and screen are in closed circuit. A large circulating load is carried to reduce overcrushing of the tungsten mineral before jigging. The finished product from the screen is transported by 18-inch belt conveyor to a 300-ton mill ore bin.

The concentrating process consists of the following steps: (a) Wet screening mill feed on 35 mesh screen; (b) Rougher jigging minus-$^3/_{16}$-inch, plus-35-mesh ore; (c) Cleaner jigging the rougher jig concentrates; (d) Grinding the jig tailing to pass 35 mesh size, after dewatering in a rake classifier, and in closed circuit with the wet screen and rougher jig; (e) Rougher tabling the minus-35-mesh product after sizing; (f) Straking the rougher table tailing; (g) Cleaning and recleaning the rougher table concentrate; (h) Floating the table concentrate; (i) Acid treating the jig and table concentrates.

D. R. RICHARDSON
Tungsten Mill Superintendent

Grinding and Concentration

The grinding and concentrating sections of the plant are in two parallel duplicate units throughout, and the mill can treat either 220 or 110 tons per day.

In each grinding unit the ore drops into a feed box ahead of a 4- by 5-foot Allis-Chalmers Areovibe screen. The screen is fitted with Tyler No. 5230 or 5234 ton-Cap stainless steel cloth, which gives a finished product approximately minus-35-mesh ready for tabling. The screen oversize is washed into a 16- by 24-inch Denver duplex mineral jig. The jig speed is 285 strokes per minute and the length of the stroke ¾-inch. The wedge bar bedding screen has ¼-inch spacing and the artificial bedding is made up of a thin layer of $^5/_{16}$ to ⅜-inch used ball bearings and pieces of ⅜-inch steel rod cut about ½-inch long, which just cover the screen.

It has been found impossible to operate the jigs without an abundant supply of hutch water. The rougher jig concentrate is drawn from the hutches at intervals and is cleaned on day shift in an 8- by 12-inch Denver duplex jig arranged for batch operation and fed by hand.

The jig tailing flow by gravity into a 4- by 18-foot Dorr type SSF classifier which suitably dewaters the pulp for grinding. When treating old tailings the jigs are not operated and the screen oversize passes over the rougher jig into the dewatering classifier. The classifier sand is laundered into the drum feeder of a rod mill which is set at right angles to the classifier. The rod mill is parallel to the feed conveyor, wet screen and jig, the tailing from which flow into the side of the dewatering classifier. This arrangement, making up three sides of a square, allows for good pulp flow. The No. 2 unit is the same except of opposite hand.

The grinding in each unit is done in a 4- by 8-foot Marcy open end rod mill operated at 25.3 revolutions per minute and driven by a 60 horsepower slipring motor through Vee belts to the pinion shaft. The rod mill is charged twice a week with 2½-inch high carbon rods. The rod mill discharge joins the dewatering classifier overflow, which is practically clear water, and is pumped with a 3-inch SRL-C sand pump to the feed box ahead of the wet screen where it washes the new feed over the screen.

Thus, the rod mill, wet screen, jig, and dewatering classifier are in closed circuit. The rod mill is operated with relatively thin pulp to reduce sliming of the tungsten mineral. The screen undersize (table feed) is pumped with a 3-inch SRL sand pump to the tabling section. All mill pumps are installed in duplicate for continuous operation.

Tables and Strakes

Sizing of the table feed is probably beneficial, at least the contrary has not been demonstrated. The feed is pumped to a sizing distributor which splits the pulp into six parts. The six pulp streams flow by gravity through 2-inch pipes to six rougher shaking tables. These tables are standing Wilfley machines fitted with black rubber covering and wood riffles. The rougher tables are run at 275 strokes per minute with a ¾-inch stroke. The slope and water are adjusted by the operators. It is endeavored to keep the feed at 25 percent solids. Each table makes only two products, a concentrate and a tailing. Before discarding, the rougher tailing is passed over six 36-inch by 14-foot strakes, arranged in two sets of three. The strakes are covered with moulded rubber riffle cloth and are set at a slope of 1½-inch per foot. An area of 2.2 square feet per ton of ore per day is provided. Additional strakes are being installed at the end of the tailing launder at the dam site. The strakes are cleaned every hour by cutting the feed off one at a time, rolling up the rubber blanket and washing it in a tank of water. The blanket concentrate is low-grade and is up-graded on one of the finishing tables.

The concentrate from the six rougher tables gravitates to three cleaner tables, one cleaner for two roughers. These tables are operated at the same speed and stroke as the roughers. The cleaner concentrate is recleaned on three recleaner tables which operate at 285 strokes per minute and ¾-inch stroke. The final table concentrate is made here. This concentrate, from both units, is collected each morning and given a batch flotation treatment in a No. 24 Denver unit cell. The reagents used are Aero Xanthate 301, pine oil, and cresylic acid. After flotation the concentrates are settled, decanted and dried ready for acid treatment. The tailings from the cleaner and recleaner tables are pumped with a 2-inch SRL sand pump to the dewatering classifier and pass through the rod mill circuit.

Table Operation

The tables are operated in such a manner that the split can be made at the concentrate end. The aim in the roughing section is to produce a low tailing and a wide cut of concentrate is made including the entire concentrate end of the table. This includes the wolframite band, the pink garnet band, and a considerable proportion of the quartz. At times a narrow band of metallic bismuth can be seen on the upper edge of the wolframite and the sulphides appear as a band of varying width on the lower side of the wolframite. The rougher table concentrate assays 10 percent WO_3.

In the second or cleaner section the concentrate removed includes the wolframite band and the garnet band, the quartz being rejected almost completely in the tailing. The cleaner concentrate assays about 22 percent WO_3 and contains the metallic bismuth and the sulphides.

In the recleaner section the final table concentrate is cut which usually assays 65 percent WO_3. The garnet is nearly all eliminated but the concentrate contains the metallic bismuth and a large proportion of the sulphides. When treating some ores the bismuth and sulphide content is high enough to reduce the WO_3 below 60 percent in the concentrate. The bismuth and sulphides are mostly rejected in the flotation concentrate, however, with negligible loss of the tungsten mineral.

An endeavor is made to keep to the following specifications for the jig and table concentrates; Tungstic oxide above 65 percent, with the maximum percentages of the impurities as follows: Sn, 1.50; Cu, 0.05; As, 0.25; Sb, 0.10; Bi, 1.00; Mo, 0.40; P, 0.05; S, 0.50; Pb, 0.20; and Zn, 0.10.

Removal of Impurities

It is found necessary to provide for the removal of copper, bismuth, phosphorous, and sulphur from the concentrates. The sulphides in the table concentrate are satisfactorily removed by flotation, along with bismuth and copper in some cases. However, the bismuth may run as high as 8.0 percent in which case the flotation step alone does not achieve the desired results. Also, the copper content after flotation often exceeds 0.05 percent, surface oxidation of the chalcopyrite accounting for the decrease in floatability.

The bismuth remaining after flotation is removed by leaching with 50 percent nitric acid in batches of 700 pounds in a small concrete mixer lined with Maxilvry AWP stainless steel. The charge is mixed for six hours, then filtered and washed in stainless steel pressure filters. The jig concentrate which is too coarse for flotation, is leached in a similar manner. Unfortunately, it is necessary to use a greater amount of nitric acid than is chemically equivalent to the bismuth and sulphides present in order to prevent precipitation of the bismuth oxynitrate. It is necessary to wash the charge in the filter with 20 percent nitric acid solution before the water wash. The nitric acid solution of bismuth is run into a large volume of water in asphalt-lined concrete tanks to recover the bismuth by the same precipitation reaction. The yellow bismuth, assaying over 99 percent $BiONO_3$ when dried, finds a ready market.

The chalcopyrite, the usual copper mineral, is not readily soluble in cold nitric acid, and when appreciable amounts of copper remain after flotation it is necessary to resort to hot leaching. This is done in 5 by 5 by 1-foot deep stainless steel pans which rest in an oil bath to eliminate uneven or excess heating. The charge is heated to 200° Fahrenheit by heating the oil to 350° F, and is constantly raked during an 8-hour leaching period. At the end of leaching, the charge is allowed to cool and is filtered as in the cold leach.

No satisfactory method of phosphorus removal has been found. The phosphatic minerals have been identified as monazite (CE La Y Th)PO_4, apatite $(CaF)Ca_4(PO_4)_3$ and xenotime YPO_4. The apatite is removed in the leaching process, but the other phosphates, although present in very small amounts, have accounted for phosphorous assays as high as 0.25 percent in the concentrates.

Indicative of the metallurgy achieved are the results on a 1.0 percent WO_3 heads from the main workings at Nababeep. The overall recovery was 90 percent of the WO_3 in the heads, the jigs recovering 50 percent at 71 percent WO_3 grade and the tables recovering 40 percent at 65 percent WO_3 grade.

THE 3-INCH TAP HOLES, located 50 to 70 feet from the burner wall are opened with an oxygen lance. Matte flows to a ladle in the crane aisle. The tapping block consists of a semi-steel plug fitted into a plate. This fits flush to the wall of the 86 by 20-foot reverberatory furnace. Tapholes are closed with a clay dolly.

O'okiep Smelting Capacity Keeps Pace With Expanded Mine Output

By E. FAIRFAX

Copper smelters, mostly of the blast furnace type, have operated in the O'okiep area of Namaqualand for a number of years. It was not until the purchase of these properties by the O'okiep Copper Company, Limited that serious consideration was given to the construction of a modern copper smelter. In 1937 preparatory work was started, and in August 1940 the first charge of blister copper was produced.

The smelter was originally designed to handle the production of the Nababeep mine and concentrator with a capacity of 12,000 to 15,000 short tons of blister copper per year. Since that time a mine and mill at East O'okiep, a mine at Concordia, and a leaching plant at Nababeep, have come into production. The yearly output with all these units is estimated at 25,000 to 27,000 tons.

The original smelter consisted of one reverberatory furnace, 86 by 20 feet, one Peirce-Smith converter, 10 by 20 feet, and a ladle tilting quadrant with a 22 foot Walker-type casting wheel. The furnace was fired by a 5- by 5-foot conical ball mill. Waste heat was converted to steam by two Foster Wheeler 3-drum boilers. The steam was utilized in a 1,750-kw turbo-alternator set with condensing plant and a 10,000-cfm. (intake) turbo-blower. Since that time, the following additions have been made:

E. FAIRFAX
Smelter Superintendent

One 7-foot by 36-inch Hardinge conical ball mill with a No. 80 Impax pulverizer as a standby.

One 10- by 20- foot Peirce-Smith converter.

One 5,000 cubic-foot-per-minute (intake) turbo-blower.

One 24-foot addition to the crane aisle.

One conveyor system for handling O'okiep concentrates.

Metallurgy Set by Mine

In direct smelting or wet charge smelting, very little control is possible over the charge as the metallurgy is

more or less fixed by the mineral components. Slags may be changed by the addition of different fluxes but the grade of the matte is strictly determined by the copper to sulfur ratio of the concentrates. At the start of production with a bornite concentrate a 60 to 65 percent matte was produced. With the addition of chalcopyrite concentrate from East O'okiep and Concordia, the matte grade was dropped as low as 31 and at the present time is around 40 percent.

In wet charge smelting, the wet concentrates are charged along the sidewalls of the furnace. The tempera ture of the charge is raised so that moisture is first driven off, then the unstable sulfur atom, and finally the sulfide melts and combines with the non-sulfide to form a slag and matte mixture.

The most important ore bodies in this district are found in feldspathic norite or basic norite. The Nababeep ore body contains a high percentage of hypersthenite, a complex $MgO{\cdot}SiO_2$. A certain amount of this is carried over with the concentrate and is very difficult to smelt, as it has an extremely high melting point.

Design Features

The layout of this smelter has a number of interesting features. Foremost, perhaps, is the unique smoke handling system. The smelter is located at the bottom of a tall, hilly ridge. The balloon flue handling both reverberatory furnace and converter gases, goes directly into the hillside at the bottom level. At this point a tunnel was blasted out, then an inclined shaft, and finally a vertical shaft to the top of the ridge. On the top a 110-foot high steel stack lined with acid-proof radial brick was constructed. From the balloon flue level to the top of the stack is 242 feet.

Contrary to usual smelter design, the reverberatory furnace was built next to the hillside and parallel to the length of the converter aisle. Skimming of slag and tapping of matte are done at the side of the furnace next to the converter aisle and travel by launders to the converter aisle. The smelter building is 168 feet long (originally 144 feet) and 110 feet wide, with the crane aisle being 50 feet wide. Concentrates from the Nababeep mill discharge from the filter to a conveyor belt and then by gravity to the smelter concentrate storage floor.

Material Handling

With a concentrate charge and sand as a flux, a very small crushing plant was constructed. Materials to be crushed are put through a 10- by 20-inch Blake-type jaw crusher discharging into a two-foot Symons cone crusher. Undersize drops on the conveyor belt which handles the O'okiep concentrates.

The Nababeep concentrates are received at the smelter as mentioned above. The O'okiep concentrates are brought eight miles from O'okiep in semi-trailers which haul a pay load of 26 tons.

Both concentrates and flux fall by gravity onto a Chinese gate of the concentrate storage floor. Below this floor another 24-inch belt extends to a 200-ton concentrate storage bin and 60-ton coal bin in the smelter building. This same belt extends further back to the main smelter coal bin.

From the concentrate storage floor the concentrates are hand-shoveled through chutes onto this conveyor. By this means a fair mix is obtained. The obvious drawback is that this is a day-to-day charging system and leads to frequent changes in the reverberatory furnace charge.

The mixed charge goes from the 200-ton concentrate bin into small coco pans. Each pan holds about 1,200 pounds of charge, and is hand-trammed to either side of the furnace. Charge holes are located on four- and five-foot centers along each side of the furnace and number 15 to a side. About 60 percent of the furnace is charged on both sides.

Future plans are to mechanize this section with a belt and tripper for each side of the furnace. A great saving in labor will be made with this mechanization.

Reverberatory Furnace

The reverberatory furnace is 86 feet long by 20 feet wide by 10 feet high, internal dimensions. The sidewalls are built mainly of superduty brick (40 percent Al_2O_3, 55 percent SiO_2). In the settling zone at the tap holes the wall is made of magnesite and is three feet thick at the bottom and two feet above the slag level. The first 10 feet of the sidewalls from the burner wall are built with burned chromag brick. The next 20 on each side are faced with burned chromag. This brick is used only on the top five feet of the sidewalls. The burner wall is 2½ feet thick and is faced with chromag brick to the burner level where it tapers to two feet and is built with superduty brick. The uptake is a special Bigelow shape and has never been rebricked. The uptake walls are a double suspended wall with superduty brick and only a small section of them has ever been replaced. The curtain wall between the two boiler uptakes is also a double suspended wall and is replaced at approximately four-year intervals. The end wall is three feet thick and built of superduty brick and has never been replaced.

This furnace was designed for a Bigelow suspended arch. At the start of operations all arch brick were superduty and 20 by 12 by 3 inches. To adapt the present Lip-tak hangers for basic brick another hanger was made. This takes the pin-type suspension brick. Four bricks, each 20 by 5¾ by 3 inches, are suspended together by ⅞-inch-diameter mild steel pins which extend through the pinhole of each brick. At the present time the arch is built of 29 feet of burned chromag brick, 12 feet metal-cased chemically bonded magchrome brick, and the remainder superduty. With all superduty brick a life of eight months was maximum, while with the basic brick

FIRST MODERN SMELTER in the O'okiep area of Namaqualand turned out 27,000 short tons of blister copper last year. This was the output of all four mines. Unique smoke handling system makes use of tunnel and shaft in hill to vent gases.

ORIGINAL SMELTER INSTALLATION contained only one Pierce-Smith converter. Two are now required to maintain high level production of copper. In an unusual departure from regular practice, leach precipitates are charged directly to the converters.

and a small amount of hot patching, campaigns are around 24 months.

Charge hole boxes are made of a light metal container surrounding an 8-inch pipe and filled with tamped grain magnesite, chrome ore cement and sodium silicate. These boxes initially last six to nine months and then must be replaced at two- to three-month intervals. When installing a new one, the bricks on all three sides are replaced. Two types of hot-patch brick are used. One is an unburned chromag and the other is the unburned metal-cased magchrome. These are made in the Bigelow shape and of 15 inch length for ease in replacement.

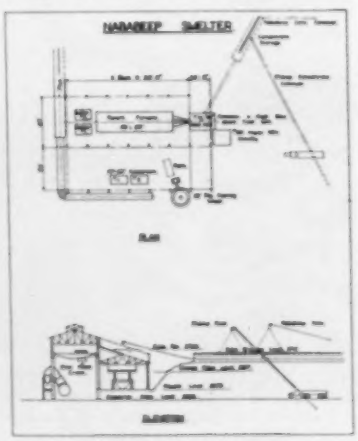
The furnace is equipped with two Foster Wheeler boilers, each of three drum type and having 3,750 square feet of heating surface. Steam is generated in these boilers at a pressure of 400 pounds per square inch and a superheat temperature of 650°F.

Each boiler is followed by a plate-type preheater and induced draft fan. Each preheater was made up of four sections and had 4,176 square feet of heating surface. Corrosion problems, lack of recirculating air, and poor design have made these preheaters a source of great trouble. Three sections have been cut out and on the next shutdown these will be completely torn out and tubular preheaters installed. At the start of operations preheated air for the pulverizer and for furnace combustion was delivered at a temperature of 400°F. At the present time the temperature is around 280°F.

Pulverized coal is used as fuel. Coal is obtained from both Natal and Transvaal collieries. The Natal coal is preferred for smelter use because it has a lower grindability.

Furnace Operation

Pea coal is fed by a Hardinge constant weight feeder to a 7-foot by 36-inch air-swept Hardinge conical ball mill with superfine classifier and fan. The coal is pulverized to 80 to 90 percent minus-200-mesh. The fan then delivers the coal to one of four burners. Each burner is circular and has a 10-inch inside diameter. Air for the mill and drying the coal is furnished by forced draft fans and the preheaters previously mentioned. Part of this preheated air combines with the coal air mixture at a point about six feet from the burner tip. A damper adjustment makes it possible to set the amount of preheated air required. The flame is quite short compared to an Impax pulverizer flame, but better flame temperatures and ignition should be obtained with the new tubular air heaters. Orsat gas analysis at a point 55 feet from the burners shows 16 to 18 percent $SO_2 + CO_2$, 0.4 to 1.0 percent O_2, and 0.0 to 0.4 percent CO, with 0.04 to 0.08 inches of draft.



Matte is tapped through either of two pairs of tapholes. Each pair has a high and low hole (three-inch difference in levels). The tapholes are 50 to 70 feet from the burner wall. The tapping block consists of a semi-steel plug fitted into a plate and this fits flush to the reverberatory furnace wall. These plugs give very satisfactory service with only one per taphole per month replacement. The three-inch diameter taphole is opened with an oxygen lance and closed with a clay dolly. The temperature of the matte is around 2,040°F.

The skimming bay is located 75 feet from the burner wall, with the sill being 24 inches above the reverberatory furnace floor level. Slag is conveyed by launder to a train of three cast steel slag pots. This train runs along one side of the converter aisle. Thus, it is impossible to skim slag and tap matte at the same time, because both products discharge next to each other in the crane aisle. The temperature of the slag is 2,240°F. when skimmed from the furnace.

Molten converter slag is returned to the furnace through a cast steel launder having a fall of 2½-inches per foot. The launder enters the side of the furnace about three feet from the burner wall.

Converting

The converting aisle is 168 feet long and 50 feet wide and accommodates two 10- by 20-foot Pierce-Smith converters, a ladle tilting quadrant, and part of the casting wheel. One end of the aisle is used for sand storage for converter flux.

Each converter is equipped with 32 two-inch tuyeres spaced on six-inch centers. They are lined with 18-inch burned magnesite brack at the tuyere line, 13 inch at the bottom and nine inch at the top. Lining campaigns vary from 6,000 to 12,000 tons, depending on the grade of matte and whether it is possible to use magnetite lining. Best tonnage has been obtained by magnetite lining but at present is not used due to lack of converter time.

The converters are rotated by 35-horsepower motors through reduction gears. An emergency power system using batteries is available in case of power failure. This system also incorporates an emergency rotating device whereby the converter automati-

(Continued on page 78)

Power Plant and Mine Shop Assure Regular Production

By R. C. MOHLER

When the Nababeep mine was reopened in 1937 a modern power plant was installed consisting of four 1,000-horsepower, Worthington Diesels, directly connected to 886-kva alternators, and a 2,186-kva Brown Boveri turbo alternator. Steam for this latter unit is supplied at 450 pounds per square inch pressure and 650°F. by two three-drum, Sterling, waste heat boilers operating on flue gases from the smelter reverberatory furnace.

In 1943, when the East O'okiep mine was being developed, a 3,000-horsepower, "M.A.N." Diesel, driving a 2,550-kva alternator was installed. This was later supplemented by two 1,000-horsepower Worthington units identical to those in the Nababeep power station.

To provide for increasing power demands, and to take advantage of the fact that power can be generated in Namaqualand more cheaply by steam than by Diesel, additional turbo generator units of 2,750 kva and 4,000 kva capacities were installed, respectively, in the Nababeep and O'okiep power stations. Additional steam for these units is provided by two Babcock-Wilcox boilers having steam outputs of 16,000 and 40,000 pounds of steam per hour.

A second 4,000 kva—40,000 pound per hour boiler unit is being installed in the Nababeep power station during the course of the next year.

Stationary, electrically driven compressors with a total capacity of 16,000 cubic feet per minute are located at different points on the property to supply air to the mines and other users. These are supplemented, where needed, by a number of portable units.

Workshops

A large and fully equipped machine shop is maintained at Nababeep and takes care of all repair work. In the boiler making section, all steel work for new construction is fabricated. Oxygen and acetylene generating plants supply all gas requirements for welding and other purposes. Carpenter, rock drill, diamond drill, and electrical shops are maintained at Nabakeep and O'okiep.

In general, workshop facilities are such as to make the company completely self-sufficient in this respect, such self-sufficiency being a "must" due to the long distance of its operations from a major engineering works.

Water Supply

Due to the sparse rainfall in the district, where the long-term average is slightly over six inches per year, the provision of adequate water supplies constitutes a major problem and expense. Initially sufficient water was available from old mines and water shafts but as operations expanded these sources became depleted to the point where it was obligatory to find new reserves. Such was found in a three, to four, square mile alluvial basin in the Buffels River some 15 miles from Nababeep. This was developed in 1947 and the procedure is to abstract water from the alluvial beds through a system of well-points connected to self-priming pumps which deliver the water to a main pump station on the river bank. From here 500 gallons per minute pumping units deliver the water to Nababeep. From there, some 150 gallons per minute is pumped a further seven miles to O'okiep.

By judicious conservation and reclamation, the total water requirements for copper and tungsten concentrating plants of a total capacity of 110,000 tons per month—two power stations generating 20,000 kva; a smelter; workshops; three major mines, three townsite areas catering to the needs of some 780 European and 800 colored employees and their families; compounds for 2,600 native employees; and various other users—are met by a total input of new water of some 600 gallons per minute.

Transport

Due to the fact that its mining operations are spread over an area of some 500 square miles, and that Nababeep is 125 miles, by road, from railhead at Bitterfontein, the problem of company transport is a major one.

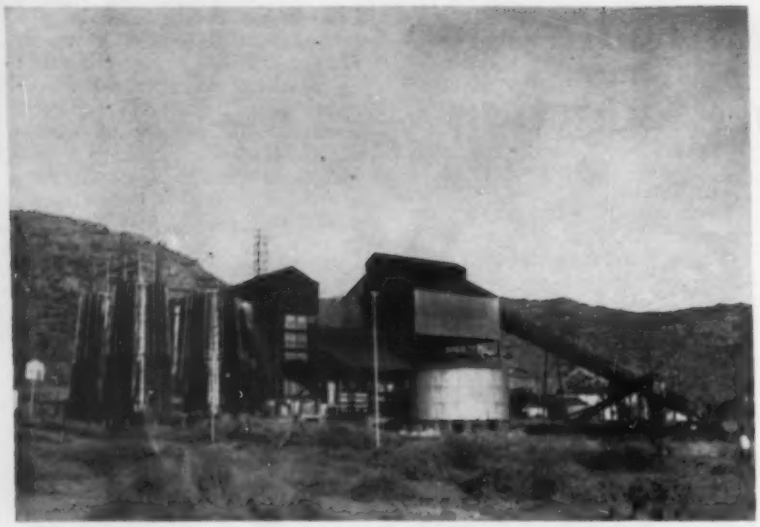
A total of some 90 motor vehicles, ranging from passenger cars and vanettes, through light to medium lorries and including 10, 20, and 30-ton Diesel units, are in use. These latter comprise a total of 25 Mack tip, full-trailer and semi-trailer units all powered by 200 horsepower Cummins Diesel engines.

A fully equipped garage is operated for the servicing and maintenance of this fleet and of other power operated equipment such as shovel loaders, bulldozers, portable compressors, and road graders.

R. C. MOHLER
Mechanical and Electrical Superintendent

W. NEUMAN
Electrical Engineer

W. A. WHITE
Assistant Mechanical Engineer



SULPHURIC ACID PLANT at O'okiep uses pyrrhotite flotation concentrate from East O'okiep mine ore as sulphur source.

How Sulphuric Acid and Lime Are Made at O'okiep

Sulphuric acid is used to leach the oxide copper ores. Because acid is not available locally and imported acid would be high priced a plant was built and placed in operation in 1949. Pyrrhotite tailings from the East O'okiep and Narrap ores are used as a sulphur source.

Due to local conditions, scarcity of water, and high power costs, it was decided to build a Mills-Packard chamber plant to produce 40 tons of 60° Baume acid per day.

In the acid plant sulphur dioxide gas is produced in a multiple hearth furnace. The sulphur content of the concentrate is maintained at 30 percent which gives the best operating results, with little fusing or building up of the roaster charge.

The feed is conveyed to a bin at the top of the roaster building, and is fed as required, 80 to 90 wet pounds per minute. Burning just starts in No. 1 hearth where the temperature is about 900° F. The temperature increases to 1,600° in No. 5 hearth, then drops to 1,000 in No. 10 hearth. The calcine, at about 5 percent sulphur, is quenched as it drops to a launder and is laundered to concrete settling tanks from which it is loaded into a truck and hauled to the O'okiep leaching dump for future recovery of about 1 percent contained copper. No attempt is made to recover all of the sulphur in the roaster as the pyrrhotite supply is adequate, but rather this section is operated to produce a gas containing 6 to 7 percent SO_2 at an outlet temperature of 900° F.

The roaster gas is drawn off from No. 1 hearth and passes into a Cottrell precipitator for dust elimination. The gas is drawn through the Cottrell by means of a variable speed fan of stainless steel construction, then forced into the base of the Glover tower. The gas at this point is 700 to 750° F., which is on the low side for best operation.

The Glover tower is of chemical brick construction. It is packed with chemical brick checkerwork and topped with quartz pebbles. The concentrated acid from the Glover tower, at 60°. Baume, is cooled to 100° F. in four water-circulated lead coolers and pumped to a 1,200-ton storage tank. The acid is drawn from the storage tank as required and delivered to the leaching plants in a tank truck. The gas leaves the Glover tower at about 200° F. and passes into the first of four Mills-Packard chambers.

The Mills-Packard chambers are round and tapered toward the top and are 50 feet high. They are kept well covered with water for cooling. From the fourth chamber the gas, containing 0.1 percent SO_2, is passed through a lead fan into the Gay-Lussac tower. This tower is also of chemical brick construction. The nitrous vitriol is run off into lead-lined wood tanks which have proved very satisfactory. The strength of the vitriol averages about 40 ounces $NaNO_3$ per cubic foot. The nitrogen loss of 15 to 20 percent is made up in an ammonia oxidation unit with a capacity of 600 pounds NH_3 per day. Ammonia liquor 25 percent is used. The gauze area is about 63 square inches.

Lime Plant

In order to ensure a steady supply of high-grade lime for the flotation concentrators, a lime plant was erected and started at O'okiep in 1952. A very large supply of dark, fine-grained, massive limestone containing 96 to 97 percent $CaCO_3$, and standing about 50 feet above the surrounding ground level, is located 34 miles from O'okiep near Steinkopf.

The kiln consists of a steel plate shell 15 feet in diameter by 30 feet high installed on a heavy masonry foundation. The foundation has a 6-foot wide service opening through it. On top of the foundation is a 2-inch cast iron slab with a 6-foot diameter hole in the center. The grate under the kiln is made of loose rails supported on heavy steel beams. The kiln is lined with three rows of 9-inch fire brick, super duty, high duty and normal duty, with a 2-inch space between the shell and the brick filled with granulated fire brick. The inside measurement of the kiln is about 10 feet in diameter by 30 feet high.

The kiln is charged with a 1¼-ton cone bottom bucket which is raised with a small electric hoist. The kiln is operated continuously, the charge being maintained at about four feet from the top by daily additions of rock and coal. In charging the kiln 3 tons (4 buckets) of cobble or nut coal with the minus-¾-inch material screened out are dropped into the kiln, followed by 12 tons (10 buckets) of limestone with the minus 1-inch material screened out. The fines are removed to allow even circulation of the gases, otherwise uneven burning occurs. This charge in alternative layers in proportion of three coal to 12 limestone by weight, gives good burning and good recovery of the limestone. The burned lime is drawn off daily, as required, into car and trammed to a slaking shed.

The production of this plant is 250 tons of hydrated lime per month. The grade of product is 86 to 90 percent $Ca(OH)_2$. It is most satisfactory having such a convenient and steady source of lime. The production can be increased materially when required.

MAKE ONE DRILL STEEL DO THE WORK OF MANY!

TIMKEN® interchangeable rock bits let you switch bits without switching drill steels

IT pays to switch bit types as the ground changes. The most economical way to do this is to use Timken® carbide insert and multi-use rock bits. In less than a minute, drillers can unscrew one type of Timken bit and screw on a different one—right on the job. No time wasted going after another set of drill steels. No need to stock expensive double inventories because dozens of Timken carbide insert and multi-use bits are interchangeable on the *same* drill steel.

When you use Timken interchangeable rock bits, you know your drillers will always have the most economical bit for the ground being drilled—Timken multi-use bits for ordinary ground, Timken carbide insert bits for hard, abrasive ground.

Both of these Timken rock bits give you two important advantages: 1) they are made from electric furnace Timken alloy steel, 2) a special shoulder union keeps drilling impact from damaging threads.

Our rock bit engineers may be able to help you with your drilling problems. They're experts in cutting drilling costs. There's no obligation. Write The Timken Roller Bearing Company, Rock Bit Division, Canton 6, Ohio. Cable address: "TIMROSCO".

WHERE YOU CUT COSTS WITH TIMKEN MULTI-USE BITS

Most economical for ordinary ground. With correct and controlled reconditioning, they give lowest cost per foot of hole when full increments of steel can be drilled.

WHERE YOU CUT COSTS WITH TIMKEN CARBIDE INSERT BITS

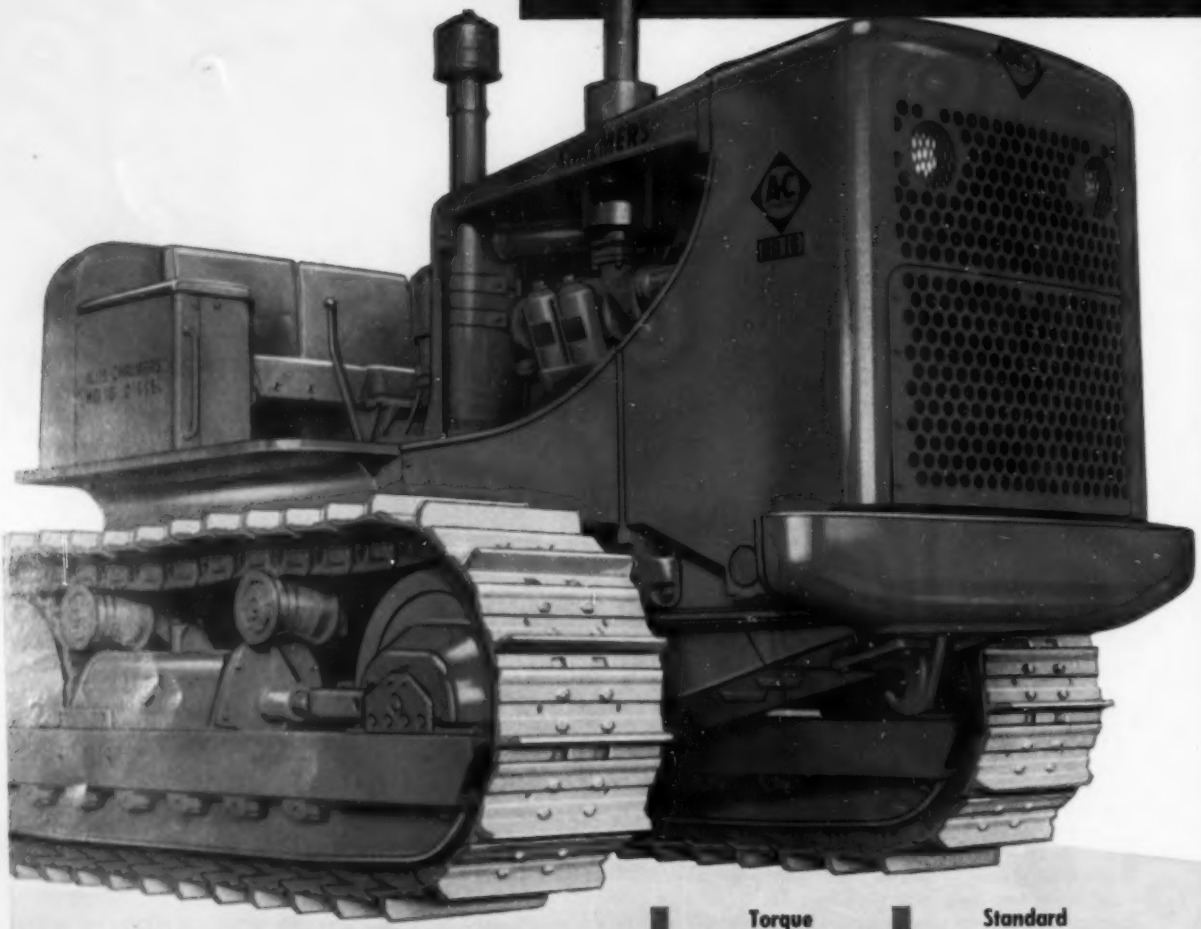
Give highest speed through hard, abrasive ground. Also most economical for constant-gauge holes, small diameter holes, very deep holes.

... your best bet for the best bit... for every job

TIMKEN

TRADE-MARK REG. U. S. PAT. OFF.

Allis-Chalmers presents the NEW HD-16



Your choice of two outstanding drives

	Torque Converter Drive	Standard Transmission Drive
Horsepower	150 net engine hp	131 belt hp
Weight	31,600 lb	31,500 lb
Drawbar pull	up to 60,000 lb	up to 35,945 lb

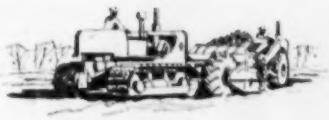
ALLIS-CHALMERS

TRACTOR DIVISION • MILWAUKEE 1, U. S. A.

NEW STANDARDS OF PERFORMANCE

for a wide range of heavy-duty work

Set your sights on an HD-16! This big new tractor not only brings you *more* power for bigger jobs . . . it makes more effective use of horsepower, with a brand new Allis-Chalmers diesel engine and your choice of two new drives — the job-proved torque converter or the easy-shift standard transmission. Either way, the HD-16 brings you a new high in tractor-operator efficiency . . . a new high in work done under even the toughest conditions.



NEW STANDARDS OF DEPENDABILITY AND LONG LIFE

under *all* conditions!

The HD-16 follows the Allis-Chalmers *advanced basic design*, with such important features as its all-steel, Box-A main frame and one-piece steering clutch and final drive case . . . straddle-mounted final-drive gears with tapered roller bearings . . . unit construction . . . simplified lubrication and service designed with *better* maintenance in mind. What's more, it is newly engineered throughout to provide big safety factors in all components . . . plus outstanding new features like the new Allis-Chalmers heavy-duty diesel engine, new "wrap-around" radiator guard, husky new transmissions, new true-dimension track, and many others.

All in all, the new Allis-Chalmers HD-16 brings you an outstanding combination of performance and long life with both mounted and drawn equipment . . . a higher rate of production, more working time, more work done, LOWERED JOB COSTS. You OWE it to yourself to get all the facts now from your nearby Allis-Chalmers dealer.

Now Available for Uranium • Minerals Exploration • Diamond Core • Mining and Quarry Blast Hole Drilling

The new Hawthorne Replaceable Blade INSERT ROCK BITS

ALL-FORMATION BITS TO INCREASE EFFICIENCY OF ROTARY DRILLING

AVAILABLE IN TYPES "E", "DB" and "AC" in range of fractional sizes from 1⅞" to 6¾"

The regular Blue Demon bit body is used with the insert blades. The regular reaming stabilizer is optional.

U.S. PATENTS
2,615,664
2,656,622
OTHERS PENDING

DEVELOPMENT of the new Hawthorne Insert Rock Bit has greatly increased the cutting capacity of Hawthorne Bits in harder formations. Like all Hawthorne Bits, these Insert Bits were developed on Hawthorne's patented interchangeable, replaceable blade design, permitting the use of many sets of blades with the same bit body.

Thoroughly lab and field tested, these Insert Bits are made of tough tool steel, using a special quality of tungsten carbide inserts on cutting surfaces. High toughness of inserts minimizes breakage, and a special welding process developed by Hawthorne prevents loosening of inserts while drilling. A unique dressing procedure produces a superior cutting edge, which permits the blades to stay sharp while drilling the harder, more abrasive formations.

PRICE LIST—COMPLETE BLUE DEMON BIT

TYPE "E"	TYPE "DB"	TYPE "AC"
$66.00	$77.00	$77.50
With E, A or B-rod sub, reaming stabilizer and set of BX Insert Blades	With N-rod sub, reaming stabilizer and set of 3⅞" Insert Blades	With N-rod sub, reaming stabilizer and set of 4½" Insert Blades

Threaded connections available to fit all standard rotary drills. Special connections can be provided on request.

PRICE LIST—REPLACEMENT BLADES, PER SET (3)

TYPE "E"		TYPE "DB"		TYPE "AC"	
AX*— 1⅞"	$20.50	NX*— 3¼"*	$22.00	4¼"* 4½"* 4¾"*	$22.50
2"— BX*	$21.00	3½"*— 3⅞"*	$22.00	5"*	$26.00
2⅜"— NX*	$21.50	4"*— 4¼"*	$22.00	5¼"*	$32.00
				6"*	$34.00
				6¼"*	$38.00
				6½"	$40.00
				6¾"	$43.00

*Denotes blades carried in stock. Others available on order. AX, BX and NX Blades are ground to gage for diamond core drill specifications.

Write for illustrated catalog covering complete range of "Blue Demon" Bit sizes for all minerals exploration requirements.

HERB J. HAWTHORNE INC.

P. O. BOX 7366, HOUSTON 8, TEXAS

United States

Personalities in the News

JOHN D. BRADLEY, who has been executive vice president of Bunker Hill & Sullivan Mining and Concentrating Company, was elected to the presidency of the Kellogg, Idaho firm, succeeding J. B. HAFFNER. In accepting the position, Mr. Bradley, also executive vice president of Bradley Mining Company, holds a post once held by his father, the late FREDERICK W. BRADLEY, who was president of Bunker Hill from 1897 to 1933.

Ralph H. Wilpolt, one-time chief of the U. S. Atomic Energy Commission's Exploration Division Geologic branch at Grand Junction, Colorado, has been named deputy director of the Exploration Division. This division, with headquarters at the Grand Junction Operations Office, conducts the AEC's program for discovery and appraisal of uranium ore deposits in the Colorado Plateau area. **E. R. Gordon** is director of the division.

S. A. Huffman, Reserve Mining Company, Duluth, Minnesota, was appointed superintendent of mechanical maintenance. Reserve is engaged in construction of a $160,000,000 project to process hard taconite rock into iron ore pellets for blast furnace feed.

W. D. Nebeker, Salt Lake City, Utah, has been named president of the new Federal Uranium Corporation which was formed as a result of the merger of ten Colorado Plateau uranium companies.

Edward L. Clark, Missouri state geologist, has obtained a three-month leave of absence to work with the Four Corners Uranium Company, Grand Junction, Colorado. **Garrett A. Muilenburd**, assistant state geologist, is in charge during his absence.

James A. Hubeli, St. Louis, Missouri, is now with the Anaconda Copper Mining Company reduction department, Great Falls, Montana.

William Wallace Mein, Jr., San Francisco, California, has been elected vice president of the American Institute of Mining, Metallurgical and Petroleum Engineers.

John Pitts, former production superintendent at National Gypsum Company's plant in Fort Dodge, Iowa, has been appointed Works Manager at the plant. He replaces **R. G. Tarbell.**

W. G. Emminger, general superintendent of the Nevada-Massachusetts Company, has announced his retirement after many years with the company. Mr. Emminger was recently appointed State Senator to serve out the term of the late **Harry A. Munk**. Succeeding him as general superintendent is **Eldridge Nash.**

W. R. McCormick has resigned from his position as plant superintendent of the Calera Mining Company's Garfield refinery, Garfield, Utah.

Lloyd A. Williamson, owner of Williamson Cascade Pumice, Bend, Oregon, is president of the Pumice Institute, which was formed early this year. Vice president of the group is **Robert H. McClure**, Matrad Corporation, New York City.

Five men on the supervisory staff of Jones & Laughlin Steel Corporation's Minnesota Ore Division were promoted recently. **Clarence H. Sleeman**, assistant to the manager since 1953, was named assistant manager. **Charles H. Grant**, mining engineer, was promoted to chief mining engineer. **William Ball**, acting superintendent of the Longyear mine, has been named superintendent of the Hill Annex mine at Calumet, Minnesota. **Julius Strande** replaced him as superintendent at Hibbing. **Dan Madich** was appointed to the position of general maintenance foreman for the division.

John A. Smrekar has been appointed supervisor of Industrial Relations for taconite operations of the Reserve Mining Company, Babbitt, Minnesota.

SUPPORTS DOMESTIC MINING

"The only way to assure an adequate supply in case of emergency is to maintain a strong, active mining industry in our own country, along with our present stockpiling program . . . the opening up and development of a new mine generally requires a period of three to six years, and . . . it would be out of the question to develop the required production after an emergency had arisen. Accordingly, we cannot urge too strongly that you establish tariff policies under which our domestic mining industry can continue to produce and to develop new ore reserves."—HOWARD I. YOUNG, president of the American Mining Congress and the American Zinc, Lead and Smelting Company, before the United States Senate Committee on Finance, March 7, 1955.

Milton F. Williams, supervisor of the Oliver Iron Mining Division, United States Steel Corporation, research laboratory, has returned from a trip to Africa and England.

Thomas J. Hubbard, maintenance and construction engineer for the Hurley, New Mexico plant of Kennecott Copper Corporation, has joined the copper firm's Utah division. His new position is in the mechanical department.

Cleveland E. Dodge, vice president of the Phelps Dodge Corporation, voiced optimism at progress at the Lavender pit operation, Bisbee, Arizona, during a luncheon for executives

HUBERT O. DeBECK, who has been a consulting mining engineer for the Baroid Division, National Lead Company, for the past year, was recently appointed evaluation engineer for the division. Formerly consulting engineer for the United States Bureau of Mines, he will maintain headquarters in Houston, Texas.

of the firm recently. He expressed the hope that the pit would continue operating for 12 or 15 years, and said that research at the laboratory pointed toward economic mining of very low grade ores.

Ray G. Knickerbocker, superintendent of the Mississippi Valley Experiment Station, U. S. Bureau of Mines, has been appointed assistant regional director. He will continue to maintain headquarters in Rolla, Missouri.

John C. Metcalf, assistant general manager of the Pickands Mather & Co. operations in Duluth, Minnesota, has retired after 38 years with the firm. He has been assistant general manager since 1939.

Ralph Thurston, general manager of Mountain Mesa Uranium Corporation, Wyoming, has resigned his position to establish a private operation.

Paul B. Jessup has been appointed secretary of Kennecott Copper Corporation, New York City, succeeding **Robert C. Sullivan.**

Fred Haley, geologist, mining engineer and field scout for 11 years with the Salt Lake City, Utah office of the United States Smelting, Refining and Mining Company, resigned April 1. He has accepted a position as mine manager for Wyoming Uranium Corporation at its uranium properties in Fremont County, Wyoming. President and general manager of Wyoming Uranium is **Hepburn T. Armstrong.**

O. R. Grawe, chairman of the geology department, Missouri School of Mines, has been elected president of Missouri Geologists at the group's initial meeting in Bonne Terre, Missouri.

C. W. Tandy, Jr., formerly with Vinegar Hill Zinc Company as a geologist, has accepted a position with Shell Oil Company in Texas.

W. A. EMANUEL, (right) superintendent of the Anaconda Copper Company zinc plant, Butte, Montana, has been named to succeed E. A. BARNARD, general superintendent of the Anaconda Reduction Department, who has retired. J. H. McCREA, assistant smelter superintendent, replaces H. J. MAGUIRE, superintendent of smelting since 1941, who is also retiring.

Mitchell H. Kline, Salt Lake City, Utah, has been elected vice president of Arrowhead Uranium Company, a subsidiary of Rare Metals Corporation, which is a joint venture of El Paso Natural Gas Company and Western Natural Gas Company.

Charles R. Skinker has been appointed secretary of Haile Mines, Inc. and its subsidiary companies, Tungsten Mining Corporation and Manganese, Inc. He has been associated with the New Jersey Zinc Company for the past ten years and assumed his new duties April 1.

William L. Walsh, formerly with General Analine & Film Corporation as manager of manufacturing, has been appointed assistant to the president of Kennecott Copper Corporation. His duties will be in the field of the corporation's titanium interests.

John A. Smrekar was named supervisor of industrial relations for operations at Babbitt, Minnesota by Reserve Mining Company which is presently engaged in developing a $160,000,000 taconite processing project at Babbitt and Silver Bay.

George T. Deck, technical director at American Potash & Chemical Corporation's main plant at Trona, California, has been named plant manager of the new American Lithium Chemicals, Inc. plant near San Antonio, Texas. American Lithium is a newly formed company owned by American Potash and Bikita Minerals (Private) Ltd. to manufacture lithium chemicals from lepidolite deposits in Southern Rhodesia, Africa.

Two new assistant directors of research, **Ernest C. Hartman** and **Philip T. Stroup**, have been appointed at the Aluminum Research Laboratories, New Kensington, Pennslyvania.

Donald C. Hardin, Jr., technical representative for Dorr-Oliver, Inc. at the Sanki Engineering Company, Tokyo, Japan, will return to the firm's Stamford, Connecticut headquarters in June. He is being replaced in Japan by **F. B. Hardon**, who begins a three-year assignment with the Japanese firm.

C. Kremer Bain, mining engineer and shaft specialist with St. Joseph Lead Company, has retired after 35 years with the firm. He has opened consulting offices in St. Louis, Missouri, and plans a trip to New Mexico in the near future.

T. C. Allen, chief engineer of the Fernald project of the National Lead Company, Cincinnati, Ohio, has been transferred to the Madison mine refinery project, Fredericktown, Missouri.

George A. Roberts, president of the American Society for Metals, pointed to a serious shortage of strategic metals and metals engineers while speaking at the Metals Congress in Los Angeles, California. Dr. Roberts, vice president of Vanadium Alloys Steel Company, said that the United States may find itself in a vulnerable position in the event of all-out emergency because of its shortage of alloys needed to make steel.

Pornchai Vimuktanandana, mining geologist from Thailand, has been selected by the United States Bureau of Mines to receive special training at the University of Idaho school of mines. Mr. Vimuktanandana has served as mines inspector in Thailand for five years and will be in the United States for approximately one year under the study program.

Marc Lintz and **John Alcott**, California mining engineers, were in Mexico during March investigating cobalt and tungsten possibilities in the Alamos, Sonora region. They were accompanied by **Alberto E. Maas**, mining engineer from Alamos.

OBITUARIES

Elton Hoyt II, 66, senior partner of Pickands Mather & Co., Cleveland, Ohio, died March 16. Mr. Hoyt, who was widely considered a leading spokesman for the iron ore and lake shipping industries, had been identified with his firm for 44 years. Under his leadership Pickands Mather organized Erie Mining Company's $300,000,000 project for recovering the iron ore content of low-grade Minnesota taconite. Last year he was awarded the Gary Medal for distinguished service to the iron and steel industry.

Norman C. Stines, 74, formerly consulting engineer and general manager for the Admiralty-Alaska Gold Mining Company's nickel and cobalt mines, died March 8 in Winnemucca, Nevada. An internationally known mining engineer, Mr. Stines worked in many countries where he developed properties for gold, copper, tin, nickel and cobalt. He was one of the key developers of the United States Smelting and Refining Corporation in Alaska.

50 years experience

in exploration and development

Boyles Bros. half century of experience and know-how has been called upon extensively in the Nation's uranium production effort. Pictured above is the shaft of the North American Uranium and Oil Co. . . . a shaft-sinking job by Boyles Bros. in the Moab area. Boyles Bros. leadership has also been long established in DIAMOND CORE DRILLING, GROUTING, ROCK BREAKING, MINING, QUARRYING and TUNNEL DRIVING.

Full details on your request

Boyles Bros. DRILLING COMPANY

1321 SOUTH MAIN STREET • DIAL 84-4401 • SALT LAKE CITY, UTAH

BRANCH OFFICES

Colville, Washington Leadville, Colorado Phoenix, Arizona

Newsmakers in International Mining

NIRAT SAMATHAPAND, director of mineral exploration for the government of Thailand, is now in the United States under a fellowship grant from the United Nations Trade and Technical Assistance program. He is taking a refresher course in diamond core drilling and rotary drilling techniques from the E. J. Longyear Company of Minneapolis, Minnesota. Much of Mr. Samathapand's time is being spent in the field, visiting specific operations of the company for actual on the job observation of the latest drilling methods and equipment, used both in mineral exploration and foundation testing.

Ross McRae, who recently completed a tour of United States mining operations, is working as a metallurgist for Australian Development N.L., Tennant Creek, Northern Territory. The Australian gold firm is currently producing an average of 3,000 tons per month of 1.5 ounce ore at its Noble's Nob mine.

Viola R. MacMillan, president of the Canadian Prospectors and Developers Association, has been reelected for the twelfth consecutive year. Other officers reelected with Mrs. MacMillan were **Cyril T. Young**, vice president; **Fred H. Jowsey**, secretary, and **Mrs. D. I. Drewe**, assistant secretary.

A. Savile Davis, manager of East Rand Pty. Mines Ltd., was elected president of the Association of Mine Managers of South Africa at a recent meeting of the group. **R. S. Cooke**, manager of Randfontein Estates Gold Mining Company (Witwatersrand) Ltd., was named vice president.

Sam Mould, who is in charge of drilling operations on the Mantos Blancos copper project in Chile, was a visitor in Lima, Peru during February. The Mantos Blancos property is owned by the Mauricio Hochschild interests and is located east of Antofagasta, Chile.

Ranchan Kanjana-Vanit, official of Tongkah Harbour Tin Dredging Ltd., has returned to Thailand after a trip to Europe.

K. C. Maithal, formerly general manager and chief mining engineer for Bogala Mines in Ceylon, has been appointed mining engineer to the government of India. He will assist the head of the mining division in the Indian Bureau of Mines, which is part of the Ministry of Natural Resources and Scientific Research.

Daniel Glary has returned to the United States from Cuba where he was associated with the Minas de Matahambre.

Jacques A. de Cuyper, Brussels, Belgium, is now in the Belgian Congo where he is employed by Union Miniere du Haut-Katanga. Union Miniere owns and operates the Shinkelobwe uranium mine as well as various copper operations in the Congo.

New employees at Cerro de Pasco Corporation's Peruvian operations include: **J. J. Bosshardt**, foreman at the Paragsha concentractor; **Giovanni del Monego**, returning as a junior mining engineer; **B. F. Fullan**, shift foreman, electrothermic zinc plant; **F. W. Levacher**, foreman, Mahr concentrator; **H. U. Schadegg**, returning as assistant master mechanic; **J. H. Weber**, chemist, general laboratory.

L. T. Nel, director of the Union of South Africa Department of Mines' geological survey, has retired after an association of 35 years with the department. Acting as interim director is **H. F. Frommurze**, assistant director.

Halvar Enermalm, manager of the Blotberget mine in Sweden, is on a two-month tour of Canada and the Iron Range area of the United States. Blotberget is one of the iron ore operations of Stora Kopparbergs Bergslags A/B. Falun, Sweden.

Leonard Harris, formerly with Taquah and Abosso Mines Ltd., Gold Coast, West Africa, has accepted a position as research metallurgist with Cerro de Pasco Corporation, La Oroya, Peru.

Recently visiting various Australian mining operations were **H. Komuro**, chief representative in Australia of Daiichi Bussan Kaisha Ltd., **S. Omoto**, Mitsui Mining and Smelting Company Ltd., and **I. Kitahara**, Mitsui Bussan Kaisha Ltd. The Japanese mining men toured Mount Isa Mines Ltd., Mount Morgan Ltd., Electrolytic Zinc Company Ltd., Electrolytic Refining and Smelting Company Ltd., and the Broken Hill Associated Smelters Pty. Ltd.

T. ZADKIN, reduction officer for the Rand Leases (Vogelstruisfontein) Gold Mining Company Ltd. with headquarters in Florida, Transvaal, Union of South Africa, has recently completed an inspection tour of mines and mills in the United States and Canada. In the United States his primary interest was in gold mills, and he visited the Homestake Mining Company, Lead, South Dakota, and the Carlton Mill of the Golden Cycle Corporation, Cripple Creek, Colorado. He also visited the plants of Climax Molybdenum Company, Climax Uranium Company, Utah Copper Division of Kennecott Copper Corporation, Montana operations of Anaconda Copper Mining Company, and the Morenci Branch of Phelps Dodge Corporation. While Mr. Zadkin's principal interest is in gold recovery, he has done much work on cyclonic classification, and the results of cyclone use in both primary and secondary grinding circuits at Rand Leases were published in the January 1954 issue of MINING WORLD. With Mr. Zadkin's cooperation, a report on the Rand Leases' new gold table was printed in the January 1955 issue of MINING WORLD. During his mill inspections in the United States he reports much interest in this table as the result of the article.

JOHN W. SVANHOLM has received an appointment as consulting economic geologist for the Burmese government's Mineral Resources Development Corporation. Mr. Svanholm has been active as an engineer-geologist in the Philippine Islands, Rumania, Germany, and Yugoslavia. He has also spent time in Sweden, the United States, and Canada studying new developments in mining and geophysics. Mineral Resources Development Corporation recently announced that large manganese deposits have been found in the Hopong state and that extensive geological and geophysical prospecting is being carried out in the area.

Johan Boman of Stora Kopparbergs Bergslags A/B in Falun, Sweden, will be in Paris, France this June attending the mining convention which marks the centennial anniversary of the French Mining Association.

A. L. Job is now with the mines department in Uganda, East Africa.

Executives of the National Lead Company and the Nickel Processing Corporation, which run the Nicaro nickel mines and plants in Cuba for the United States government, made a recent inspection trip of the operations. The visitors included: **Joseph A. Martino**, chairman of the boards of directors of the two firms; **Harry C. Wildner**, vice president of National Lead and president of Nickel Processing; **Alfred H. Drewes**, **Joseph H. Reid**, **William J. Welch**, **William V. Burley**, **David A. Merson** and **George L. Ratcliffe**, vice presidents of National Lead; **Rafael L. Gonzales**, vice president and director of Nickel Processing; **Oscar Garcia Montes**, director of Nickel Processing; and **John B. Henrich**, secretary of both firms. The facilities are currently in the process of a $43,000,000 expansion program.

Frank Cameron, Saudi Arabian Mining Syndicate Ltd., has returned from Jeddah, Saudi Arabia, and is now at his home in Jenkintown, Pennsylvania.

L. Mayger, plant superintendent at Macalder-Nyanza Mines, Kenya, was recently in Johannesburg, Union of South Africa.

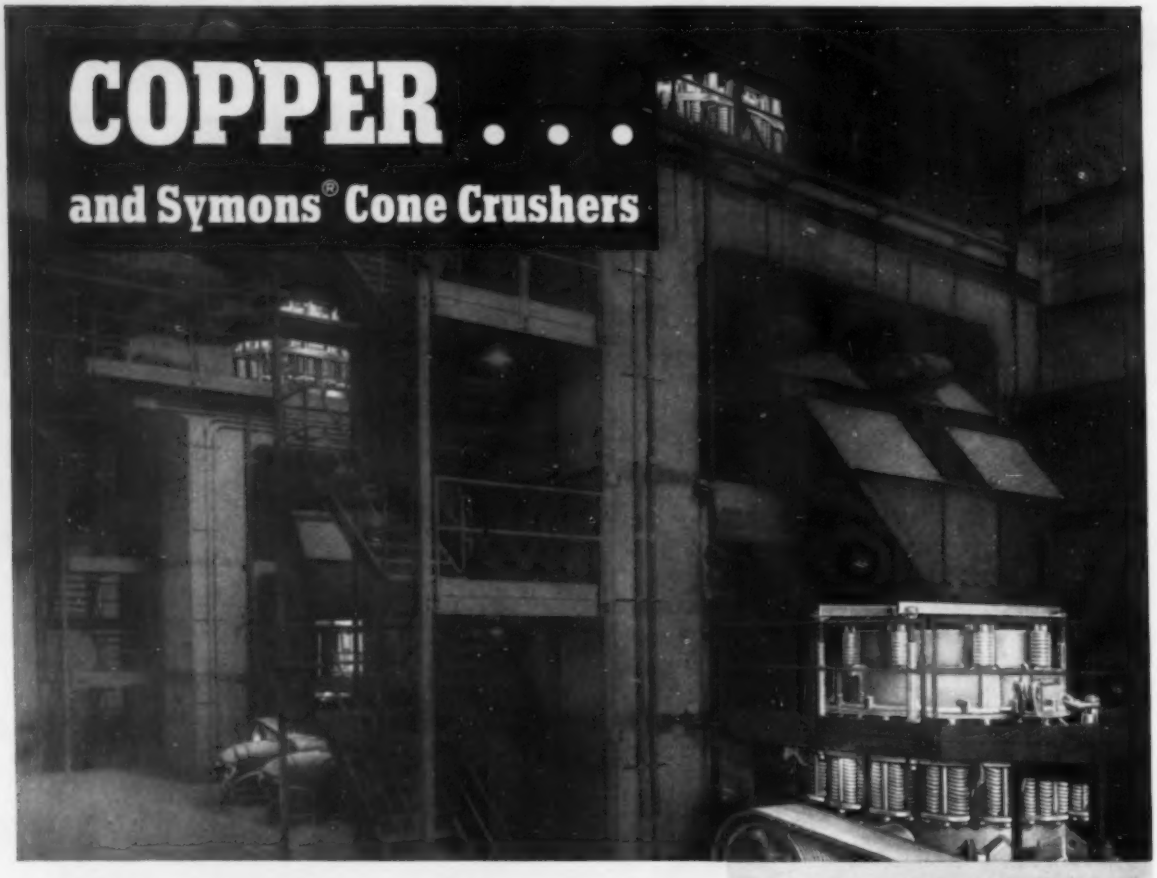
S. G. Gamble has been appointed chief topographical engineer of the Surveys and Mapping branch by the Federal Mines and Technical Surveys, Canada. He succeeds **P. E. Palmer**, who has retired.

Roberto M. Reich, until recently chief engineer at Cia Minera Aguilar S.A. in Argentina, has been named to a similar position at the Sominar S.A. tungsten mine, Los Condores, near San Luis, Argentina.

I. H. Warren, formerly with English Clays Lovering Pochin & Company, Ltd., Cornwall, has taken up a position with the Division of Industrial Chemistry in Melbourne, Australia.

COPPER . . .

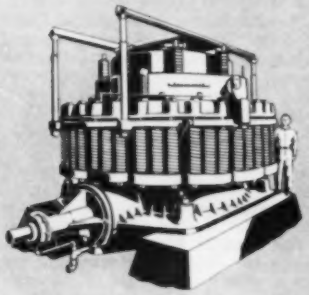
and Symons® Cone Crushers



COPPER . . . and Symons® Cone Crushers

Symons Cone Crushers . . . the *machines that revolutionized crusher practice . . .* have long proved their efficiency, dependability and economy in the profitable reduction of ores and minerals the world over. In the case of COPPER, it is significant that more than 90% of the world's production passes through Symons Cone Crushers. Throughout the entire COPPER industry, the new and repeat orders for these crushers are continued evidence of the satisfaction given in fine reduction crushing service. The outstanding performance of Symons Cones in delivering a finely crushed product in greater capacities and at lower cost makes them the leading choice of the world s outstanding mining companies.

NORDBERG MFG. CO., Milwaukee, Wisconsin C554-R



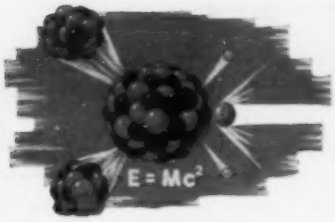
Symons Cone Crushers are built in Standard, Short-head and Intermediate types with crushing heads from 22″ to 7′ in diameter — in capacities from 6 to 900 tons per hour.

SYMONS . . . A REGISTERED NORDBERG TRADEMARK KNOWN THROUGHOUT THE WORLD.

NORDBERG

MACHINERY FOR PROCESSING ORES and INDUSTRIAL MINERALS

NEW YORK • SAN FRANCISCO • DULUTH • WASHINGTON
TORONTO • MEXICO, D.F. • LONDON • JOHANNESBURG



FISSION FACTS

Monthly Roundup of Mining News In the Atomic Energy Field

Johnson Sees Adequate U_3O_8 At $12 Per Pound

Jesse C. Johnson, director, Division of Raw Materials, United States Atomic Energy Commission, reports that uranium is rapidly becoming just another strategic material and that we can look forward to adequate supplies to meet foreseeable military and industrial requirements.

He goes on to state that first domestic uranium production came from deposits containing only a few thousand tons of ore. A 10,000- or 20,000-ton ore body was considered large. During the past three years a number of deposits have been found which contain more than 100,000 tons and at least one contains several million tons. Probably 80 percent of the United States' present known ore reserves are in deposits larger than 50,000 tons; these are deposits that can supply uranium at a moderate cost, less than $12 per pound of U_3O_8.

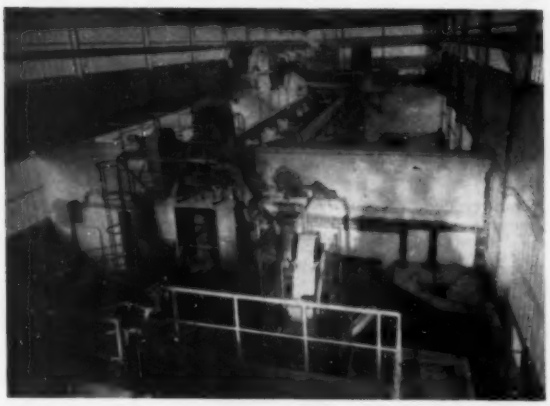
Private exploration is now active in all parts of the country where some evidence of uranium has been found and new discoveries are adding uranium reserves faster than they are being mined. Recent discoveries in Texas and Washington may prove important, adding to the reserves of the Colorado Plateau, Wyoming, and North and South Dakota.

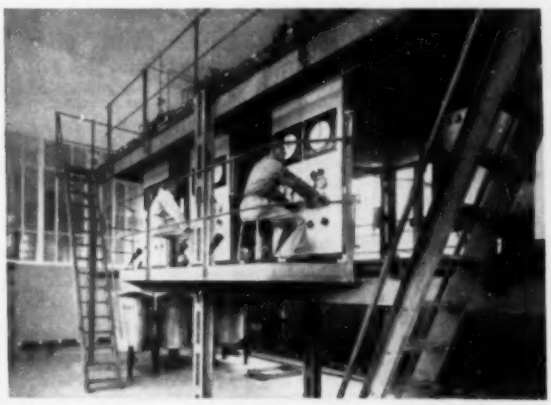
Today, private uranium expenditures in the United States have a value of about $100,000,000 per year. In Canada, during the past two years private financing arranged for three Canadian uranium projects totals $70,000,000.

In addition to this there are the extensive Canadian Government operations and many other private explorations and development projects. Investment in South African uranium mills is now approaching $150,000,000 and upon completion of the present program will be about $180,000,000. Uranium activities in Australia and Portugal are on a smaller scale, but there are possibilities for major expansion.

In addition to uranium deposits now being mined, domestic phosphate and shale deposits constitute a large low-grade reserve. Commercial phosphate rock in Florida and the western states is placed at 5,000,000,000 tons, containing an estimated 600,000 tons of U_3O_8. Tennessee and adjoining states have about 85,000,000,000 tons of shale which represents a reserve of 5,000,000 to 6,000,000 tons of U_3O_8. Outside of our United States, but in the Free World, many other large low-grade deposits of uranium are known to exist.

Areas of the Free World now producing or developing uranium have reserves that could be developed at a moderate cost that may total between 1,000,000 and 2,000,000 tons of U_3O_8.





How Metallic Uranium Is Produced In France

Uranium producers should be interested in the following brief description of how uranium metal is produced from ores and concentrates. The process described is that of the Bouchet refinery located near the town of Ballancourt, France, and owned by the French Commissariat à l'Energie Atomique. Undoubtedly somewhat similar methods are being used in the United States. The above pictures are some of the first to be shown of this type of a metallurgical plant.

The refinery's source of uranium ores and concentrates is several deposits in France and Madagascar. After crushing and drying the incoming ores and concentrates, they are stored in a series of bins. The above picture (left) shows this section of the plant. From the storage bins, ores and concentrates are fed to vats and treated with hot nitric acid, dissolving the uranium and forming uranium nitrate.

Fine particles in the uranium nitrate solution which contain a small amount of uranium are removed by pouring the liquid gently from the vats. The small amount of uranium contained in the insoluble residue is recovered by subjecting it to several washings. Clear uranium nitrate solution is then sent to other vats. Carbonate is added precipitating other impurities which are in the form of carbonates, phosphates, and oxides.

The next process is precipitating the uranium by adding caustic soda. This is again accomplished in vats. The precipitate, sodium uranate, is then filtered in presses into orange-yellow colored cakes. These cakes are dissolved in concentrated nitric acid, once again forming uranium nitrate. Organic chemicals are then added to the solution precipitating the uranium as uranium nitrate and leaving all of the remaining impurities in solution. The above picture (right) shows the control board used in governing the precipitation of the uranium nitrate. The precipitate is re-dissolved with distilled water and, later, precipitated through oxygenated water in the form of a hydrated peroxide.

The peroxide is filtered with vacuum filters and dried in two separate types of ovens. By drying up to a temperature of 400° Centigrade the uranium peroxide is reduced to UO_3. This product is again heated in ovens at a higher temperature and in a reducing atmosphere of hydrogen, transforming the UO_3 into UO. This uranium oxide is then placed in vats and dissolved with hydrofluoric acid. The resulting solution is filtered and the solids, uranium fluoride, dried in ovens. Granules of the uranium fluoride are mixed with flakes of calcium and the resulting mixture placed in vats. On the bottom of each vat is a hollow cylindrical crystal of pure sintered fluorine.

An exothermic reaction of the mixture in the vats is started by igniting an added easily inflammable product. This reaction lasts for approximately 12 seconds. Liquid uranium formed during the reaction congregates inside the crystal of fluorine. When the reaction has taken place, the vats are cooled for approximately 24 hours and the ingot of uranium metal removed. Weight of the ingot is about 70 kilograms (154 pounds) and is 99.99 percent pure uranium.

NO PART OF THIS PAGE MAY BE REPRODUCED WITHOUT WRITTEN PERMISSION.

Mining World

THE IMPORTANT MINING MAGAZINE EVERYWHERE

INTERNATIONAL NEWS

COSTERMANSVILLE, BELGIAN CONGO—The Kinoretain mine group is building a new cyanide plant at its Namoya mine and mechanization operations to reduce production costs.

WASHINGTON, D. C.—The United States Department of Agriculture has received $18,600,000 worth of strategic minerals from foreign countries by bartering deals using grains and cotton in payment.

STOCKHOLM, SWEDEN—The Swedish government plans to purchase the stock in the Loussavaara-Kiirunavarra Company held by the Grangsberg Trafiglat for $188,224,000. The government already owns 50 percent of the stock of Loussavaara which operates the largest iron ore mines in Sweden.

JEFFERSON, NORTH CAROLINA—Nipissing Mines Company has started sinking a 1,000-foot shaft to develop its Ore Knob copper property. Surface drilling has indicated 1,219,700 tons of 3.09 percent copper ore with values in cobalt, zinc, gold, and silver.

MT ISA, QUEENSLAND—The Australian copper price is now set monthly and is the average London price during the preceding month. Australian price was up to £ A 431 in April which is more than £ A 100 higher than a year ago under government price control.

MONTICELLO, UTAH—The United States Atomic Energy Commission is shipping uranium ore from its stockpile here to the new mill of Kerr-McGee Oil Industries, Inc's Uranium Division at Shiprock, New Mexico.

LISBON, PORTUGAL—The Portuguese Atomic Energy Commission is to survey and prospect for uranium in a 12,000-square-kilometer area south of the Douro River. Both air and ground methods will be used.

KITIMAT, BRITISH COLUMBIA—Aluminum Ltd. has announced plans to double its aluminum plant capacity here to 330,000 annual tons. Increased bauxite mine production in Jamaica is also planned.

ARGENT, UNION OF SOUTH AFRICA—The Consolidated Gold Fields of South Africa, Ltd. is equipping its mine here for future production when metal prices warrant. Deep seated deposits of lead-zinc-silver-copper have been prospected.

RUM JUNGLE, AUSTRALIA—The first shipment of uranium concentrate has been made to the United States from the new mill of the Territory Enterprises Proprietary Ltd. Value of the shipment was $450,000 but weight was not released.

NOUMEA, NEW CALEDONIA—Nickel production is to be increased here by the reopening of the Pentecote mines on the east and west coast. The low-grade ore will be shipped to Japan for smelting.

LOANDA, ANGOLA—An exclusive mineral concession has been applied for covering a large area in southern Angola by Jules Harroy and the Belgian firm, Compagnie Financiere et Industrielle (CONFINANDUS).

VIRGINIA, ORANGE FREE STATE—A new gold-uranium mine will probably be developed in the Van Den Heevers Rust area west of the Freddies Consolidated Mines.

MOAB, UTAH—Kenneth W. Davis, director of reactor development for the United States Atomic Energy Commission has predicted that nuclear power plants will produce 100,000,000 kilowatts of power in 1977. This is equal to total United States power capacity today.

JOHNSVILLE, TENNESSEE—The E. I. duPont Company has received a certificate to amortize the $40,000,000 cost of a titanium sponge plant in five years.

EDGEMONT, SOUTH DAKOTA—Mines Development, Inc. is negotiating with the United States Atomic Energy Commission for construction and operation of a plant to treat uranium ores from the Black Hills and adjacent areas.

Centenary Celebration In Paris June 18-July 3

The Centenary Congress of the Societe de l'Industrie Minerale meets in Saint-Etienne June 16 to 18 and in Paris June 18 through July 3.

The working sessions, to be held in Paris (except for the first session at Saint-Etienne), will be grouped under seven special subjects: thick seams June 16-18, iron and steel June 20-23, mechanized getting and loading in longwall faces June 20-22, mechanized getting and loading in room-and-pillar workings June 22-24, mineral discovery June 27-30, underground electrification June 27-29, and the mine of the future June 30-July 1.

Open throughout the duration of the Congress will be the International Exhibition of the Mining Industry, where the latest equipment by French and foreign manufacturers will be displayed. There will be models of mining works or of recent mining and metallurgical installations, along with works of art inspired by mining or metallurgy.

The Societe's address is 60, Boulevard Saint-Michel, Paris (VI°).

Cerro de Pasco Plant Shifts To Company Ores

The first of this year marked the end of Cerro de Pasco Corporation's contract with Volcan Mines for the milling of Carahuacra ore. The Mahr concentrator is now exclusively milling Cerro de Pasco ore from San Cristobal and San Antonio mines in the Yauli area of Peru, with supplemental tonnage from Morococha, Yauricocha, and custom shippers. Mill capacity will be increased as demands require it.

About 35,000 tons mined during the development program at the San Cristobal have been stockpiled at the Mahr Tunnel concentrator to serve as a reserve in the event of a breakdown in the nine-mile aerial tramway operating between the mine and the plant. During the year, this ore will be fed to the mill along with the newly mined ore.

Although lead, copper, and zinc are the principal minerals in San Cristobal ore, some tungsten is also present. It is hoped that an additional plant for tungsten recovery will be in operation at Mahr Tunnel by the end of 1955.

Australia Ships First Uranium to United States

Australia has shipped its first consignment of uranium oxide concentrate to the United States under a 10-year agreement between the United States and Great Britain. Worth $450,000, the uranium was produced at the new Rum Jungle processing plant in the Northern Territory operated by Territory Enterprises Pty. Ltd, a subsidiary of the Zinc Corporation, for the government.

High-Grade Brazilian Manganese Ore Body To Be Developed at a Cost of $67,500,000

A $67,500,000 project to mine, transport, and ship strategic manganese ore is now underway in the Brazilian Federal Territory of Amapa. This large project is being undertaken by Industria e Comercio de Minerios S. A. (ICOMI), and is financed by a loan from the Export-Import Bank. A 49 percent interest in ICOMI is owned by the Bethlehem Steel Corporation.

Amapa lies on the north bank of the Amazon River and is bordered on the north by French Guiana and on the east by the Atlantic Ocean. The deposit is located at Serra Do Navio and constitutes one of the few major sources of high-grade manganese in the world. According to Robert D. Butler, geologist for Bethlehem Steel and on the board of directors for ICOMI, the deposit consists of 20 distinct ore bodies, some of which are connected below the surface to provide a continuous ore zone. The ore bodies are located along the tops and flanks of hills and ridges. In shape they resemble large irregular pods; in size they range from about 20,000 tons to more than 3,000,000 tons. They are exposed on the surface and rarely exceed 200 feet in depth.

Exploration to date, has proven reserves totaling 14,000,000 tons of shipping grade ore. About 65 percent of the length of the ore zone has been tested by drilling. An initial minimum production rate of 500,000 tons per year has been planned. This goal can be increased if necessary by the addition of extra mining and transporting units.

The construction phase of the project began in early 1954, and is scheduled for completion sometime before 1958. Construction of port facilities at Porto Santana, a 121-mile railroad connecting the port and mine, and mine facilities is being done under contract by Foley Brothers, Inc. The ore loading dock under construction at Santan, on the Amazon River, will be a floating one as the river has an average rise and fall of 12 feet. Although the conveyor loading system is still in the design stage, it is estimated that it will have a capacity for handling 2,000 tons of ore per hour.

The railroad now being built through the jungle from Porto Santana to the manganese deposits at Serra do Navio is new in many respects. It will be the only railroad in Brazil north of the Amazon and the only standard gauge railroad in the nation. The deposits are located at an elevation of 482 feet above that of the port. Ruling grade for loaded trains will be 0.035 percent on the main line. Maximum grade for empty trains will be 1.5 percent. Diesel-electric locomotives will be used. Completion of the railroad is expected in October 1956.

Mining will be by open-pit methods using 20-foot benches. Broken ore will be loaded with Diesel shovels into trucks and hauled to a crushing and washing plant to be located at the mine. From here it will travel a short distance by belt conveyor to railroad loading bins. A village for some 1,000 to 1,200 natives will be built near the mine, as well as a staff camp for administrative personnel.

Since the United States must import more than 90 percent of its manganese, this Brazilian project constitutes an important source of supply. Production from this deposit will greatly benefit both Brazil and the United States.

India and Russia Agree On Terms for Steel Plant

India and the Soviet Union have signed an agreement providing for construction of a steel plant in Central India at a cost of Rupees 100 crore. The plant will be completed by 1959, and will have a capacity of 1,000,000 tons annually.

This will be India's second steel plant to be constructed with foreign assistance. Two more are contemplated, one of which reportedly will be erected with the aid of a British concern. Already under construction is one in Orissa which will cost Rupees 72 crore and its initial production capacity is 500,000 tons. The German steel combine, Krupps-Demag, is supplying technical aid.

Under the new contract, the Russian contribution will be in the form of machinery. The Soviet Union will be repaid in 12 annual installments at a rate of 2.5 percent interest per annum which is about one percent less than interest on the German loan. Other provisions permit Indian experts to visit the Soviet Union and to see the operation of similar plants.

Bethlehem Subsidiary Produces Iron Pellets

First shipments are expected this month from the Marmoraton Company's new $15,000,000 open-pit iron ore mine at Marmora, Ontario, Canada. Under development by this Bethlehem Steel Company subsidiary for about three years, some 3,700 tons of ore will be mined each day to enable the plant to produce 1,500 tons of high-grade pellets. The concentrate will run 60 to 65 percent iron and will be shipped to Bethlehem's steel plants at Lackawanna, New York at the rate of 500,000 tons annually.

Rio Tinto Gets 51% Of Australian U_3O_8 Firm

Australasian Oil Exploration Ltd. has signed an agreement giving Rio Tinto Ltd. a 51 percent interest in its subsidiary company, Mary Kathleen Uranium Ltd. near Mt. Isa, Queensland, Australia. Australasian will have a 39 percent interest, and the original discoverers a 10 percent holding. Rio Tinto will direct the exploration of the lease and has already begun work.

Finances for this work will be provided from the purchase money paid by Rio Tinto. In addition, Rio Tinto will arrange financing of up to £A6,000,000 for the erection of a treatment plant and the intensive development of the area if justified. It will also provide technical management, and operational facilities, and, if a treatment plant is constructed, will try to arrange for long-term contracts for the sale of uranium oxide.

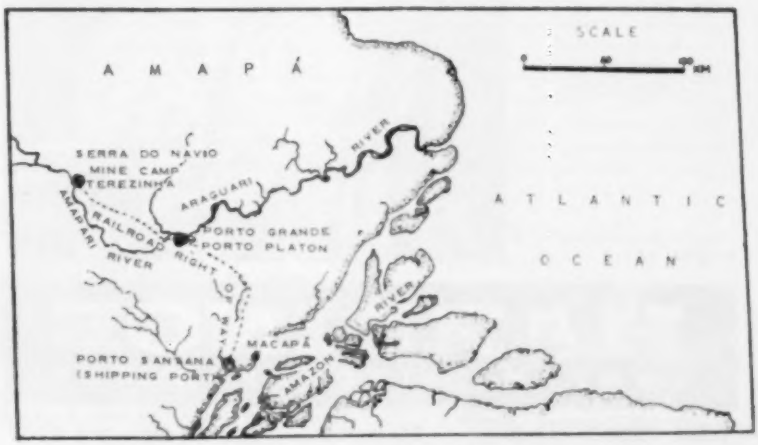
Rio Tinto has already asked the South Australian Mines Department to assist in developing the Queensland deposits by undertaking a thorough investigation of the ore and by establishing an economic process for treatment. Samples have been forwarded for laboratory and pilot plant investigation work.

Atlas Copper's New Mill Treating 1.2 Percent Ore

Milling rate of Atlas Consolidated Mining and Development Corporation's new copper flotation mill at Toledo on Cebu Island, Republic of the Philippines, had been increased from its initial 1,000 ton-per-day rate to 3,000 tons daily by April. The mill went into production on February 23.

During the first month, the heads assayed about 1.2 percent copper which is a higher grade than the average reserves which presently total 35,000,000 tons of 1.08 percent copper ore. An open-pit mine was developed while the mill was being built.

With an ultimate capacity of 4,000 tons, this will be the largest base metal mill in the Far East. It was fully described in the September 1954 issue of MINING WORLD, pages 62 to 65.



Place-fix map showing locations of new mine, port, and railroad.

UNION OF SOUTH AFRICA—The uranium program of the gold mines has received a marked boost this year with commissioning of four new plants—at *Luipaards Vlei, President Steyn, Welkom,* and *Vogelstruisbult.* Like its northern neighbor, *Daggafontein Mines, Ltd., Vogelstruisbult Gold Mining Areas Ltd.* is mining both the main and Kimberley Reef horizons. All of the development so far advanced on the latter has been confined to the northeastern section of the property, that is in the areas served by No. 1 and 4 shafts. Ore reserves on both horizons over the past three years have reflected a slight but steady increase from 3,173,000 tons averaging 5.5 dwt over 42.3 inches at the end of 1952, to 3,207,000 averaging 5.5 dwt over 42.4 inches at the end of last year. This was achieved despite the increase of 25,000 tons a month to 100,000 in the designed milling capacity during 1953, and the expansion in milling from 990,500 tons in 1952 to 1,229,000 in 1954. The indications are that the proportion of Kimberley Reef in the ore reserves has progressively risen over the last few years. The reduction plant has been redesigned to provide two separated circuits—one for treating Main Reef ore, the residues from which are delivered to a flotation plant and which yield a uranium-enriched pyrite concentrate; and the other for treating Kimberley Reef ore, which has a higher uranium content than Main Reef. The flotation plant also concentrates accumulated residues from the Main Reef slimes dam. The concentrated product is combined with current and accumulated Kimberley Reef residues and delivered to the uranium plant. No sulphuric acid is produced by the Vogelstruisbult mine.

ANGOLA—Jules Harroy, in connection with the Belgian group—*Compagnie Financiere et Industrielle* (*Confinandus*), has applied to the Portuguese government for an exclusive mineral concession in Angola. The area is located between the Meridians East 14°30′ and 13°30′, and parallels 15°00′ and 16°30′ south. The area is known to contain several large deposits of magnetite and titanomagnetite, and several claims have been staked there prior to the application. The applied concession lies north of the Cunene River, in the southern part of Angola.

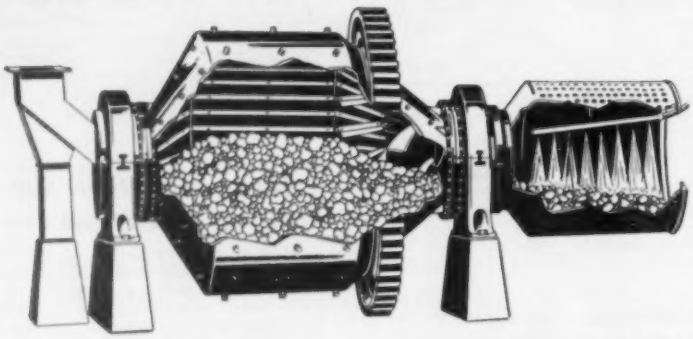
FEDERATION OF RHODESIA AND NYASALAND—*Sebungwe Mines & Exploration Company (Pvt.) Ltd.* has withdrawn from the *Copper Queen* and *Copper King* mines west of Sinoia, Southern Rhodesia after spending more than £200,000 on geological and geophysical work, including an extensive drilling program. Sebungwe was formed by the *Newmont Mining Corporation* subsidiaries, *Tsumeb Mining Corporation* and *O'okiep Copper Company,* and had a three-year option on the mines. (See MINING WORLD, March 1955, page 65.)

TANGANYIKA—Production from *Williamson Ltd.'s Mwadui* diamond mine totaled 318,000 carats in 1954, double that of 1953. The new plant being erected contains all kinds of innovations. Tube mills using 2-inch balls will be used to break up the ore, which will then go to cyclones. The concentrates will be ground in slow running ball mills to eliminate the softer elements such as limonite, and separation of the diamonds will be made on traveling grease belts and in electrostatic separators. Cyclones will be used for sorting the finer sizes.

UNION OF SOUTH AFRICA—*Klerksdorp Consolidated Goldfields Ltd.* is now proceeding with the initial phases of development on the Dominion Reef Series by means of incline winzes being sunk on the reef horizon from the outcrop. In the neighboring property of *Dominion Reefs (Klerksdorp) Ltd.* this uranium-bearing horizon has been exploited for some years for its gold content, and uranium production will be initiated this year.

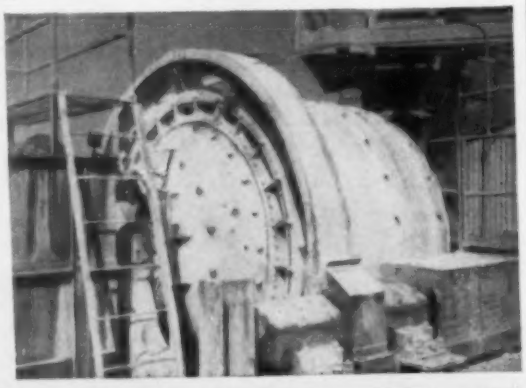
BELGIAN CONGO—*Compagnie Miniere des Grands Lacs Africains* produced 1,989 kilograms of gold ingots, in 1954, along with 1,301 tons of cassiterite, 87 tons of mixture (cassiterite mixed with wolframite and columbo-tantalite) 123 tons of columbo-tantalite, and 82 tons of wolframite. In 1953, the production amounted to 2,043 kilograms gold, 1,171 tons cassiterite, 154 tons mixed as above, 64 tons of columbo-tantalite, and 75 tons of wolframite. The *Simetain* company produced a total of 5,600 tons of cassiterite in 1954, compared with 5,510 tons in 1953.

HARDINGE SCRUBBERS FOR PIT-RUN MATERIALS



Large diameter, short length trunnions permit chute feeding of unsized ore and rock at rates up to 600 tons per hour.

The mass loading and ball-mill action in the scrubber quickly and completely slurries the clay and dirt, permitting ready separation on washing screens or trommels.



View of a 10′ x 66″ Hardinge Scrubber cleaning crushed dolomite in a California plant.

BULLETIN 37-A-3

HARDINGE
COMPANY, INCORPORATED

YORK, PENNSYLVANIA • 240 Arch St. • Main Office and Works

New York • Toronto • Chicago • Hibbing • Houston • Salt Lake City • San Francisco

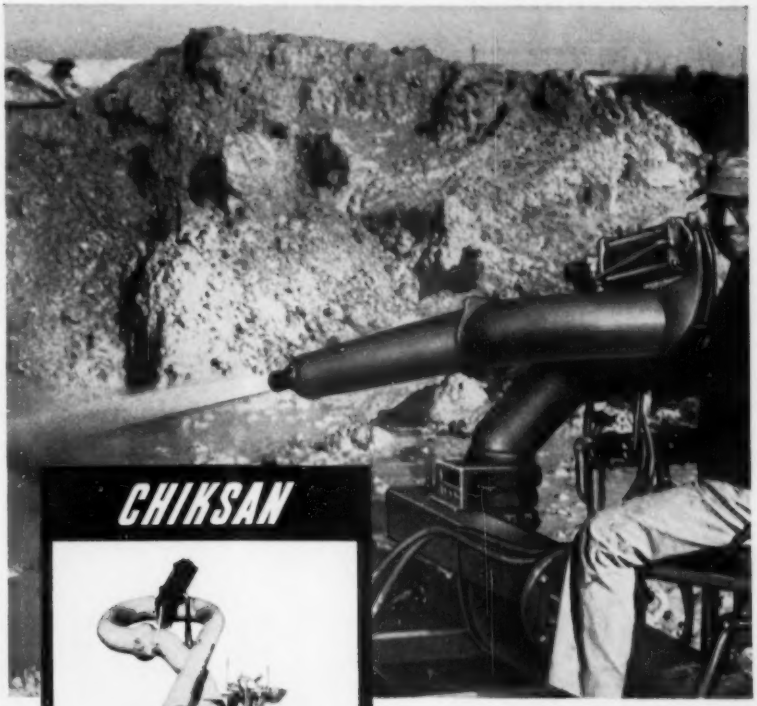
FEDERATION OF RHODESIA AND NYASALAND—*Cam & Motor Gold Mining Company, (1919) Ltd.* is raising funds to undertake new low level mining in the old *Cam* mine in Southern Rhodesia. Development results at the bottom of the mine during the past two years have been considered extremely encouraging, and future mining is now planned at a 10,000-foot depth; the present lowest level is 5,000 feet. Plant changes are also planned so that recovery can be improved.

UNION OF SOUTH AFRICA—*Freddies Consolidated Mines Ltd.* has suspended development operations in the southern section of its lease area—that is, the area served by the two shafts of what was *Freddies South Lease Area Ltd.* before the recent amalgamation. Recent developments in the area disclosed low values resulting in only small additions to the ore reserves. Mining of these reserves will continue as long as the operation proves profitable. Higher values have been disclosed in the area served by the two northern shafts and the company's remaining resources are being devoted to operations there. In the two reduction plants four milling units have been installed with an overall capacity of 130,000 tons a month. Each unit consists of a primary ball mill and two secondary pebble mills. Treatment of selected residue slime is now being carried out in the Welkom uranium plant.

BELGIAN CONGO—The Belgian mining company, *Kinorétain*, is doubling its capitalization to obtain additional working capital for increased production from its tin and tungsten operations, and to make steady profits from its gold operations at the *Namoya* mine. The firm operates in the Kindu mining district of Kivu province. Tin and tungsten production in 1954 was 2,174 tons, an increase of 18 percent over the 1,833 tons of 1953. The company plans to mechanize operations; to build a cyanide plant at the gold mine; and to construct two hydroelectric power plants of 3,000-horsepower each.

FEDERATION OF RHODESIA & NYASALAND—Production from the relatively high-grade *Chibuluma* copper-cobalt mine in the *Rhodesian Selection Trust* group is expected to be started later this year. The main hoisting shaft has been sunk. The mine is being developed by *Chibuluma Mines, Ltd.* near Kitwe, Northern Rhodesia.

UNION OF SOUTH AFRICA—*St. Helena Gold Mines Ltd.* has started the sinking of a third shaft in the northeastern section of its lease area adjoining the properties of *Western Holdings Company, Ltd.* and *President Brand Gold Mining Company, Ltd.* Of the two existing shafts, No. 3—a 30° incline unit—is exclusively used as a ventilation shaft. The main hoisting shaft—No. 4, which is an elliptical vertical unit—has a capacity of about 100,000 tons a month. From its lowest level, a prospect winze is being sunk which may later be enlarged to a sub incline shaft. Reef development so far has been confined to the sub-outcrop zone in the central and northern sections. There contour reef drifts have been advanced on alternate levels at vertical intervals of 340 feet, with the intermediate levels and contour drives cut subsequently midway between the primary levels. To facilitate hauling in the drifts, large radius curves are provided.



intelli-giants will improve your slurry operations

The Chiksan Intelli-Giant – the greatest improvement in hydraulicking in 90 years – is making the handling of solids by slurrying increasingly economical.

In delivering minerals, ore, sand, or gravel from their source to a solids pump, it is important to keep the percentage of solids in line with the maximum capacity and efficiency of the slurry pump.

Intelli-Giants in the Florida phosphate fields are increasing yardages moved by some 25%. When handling 800 to 1000 tons per hour at a ratio of 40% solids the increase in production amounts to thousands of dollars daily.

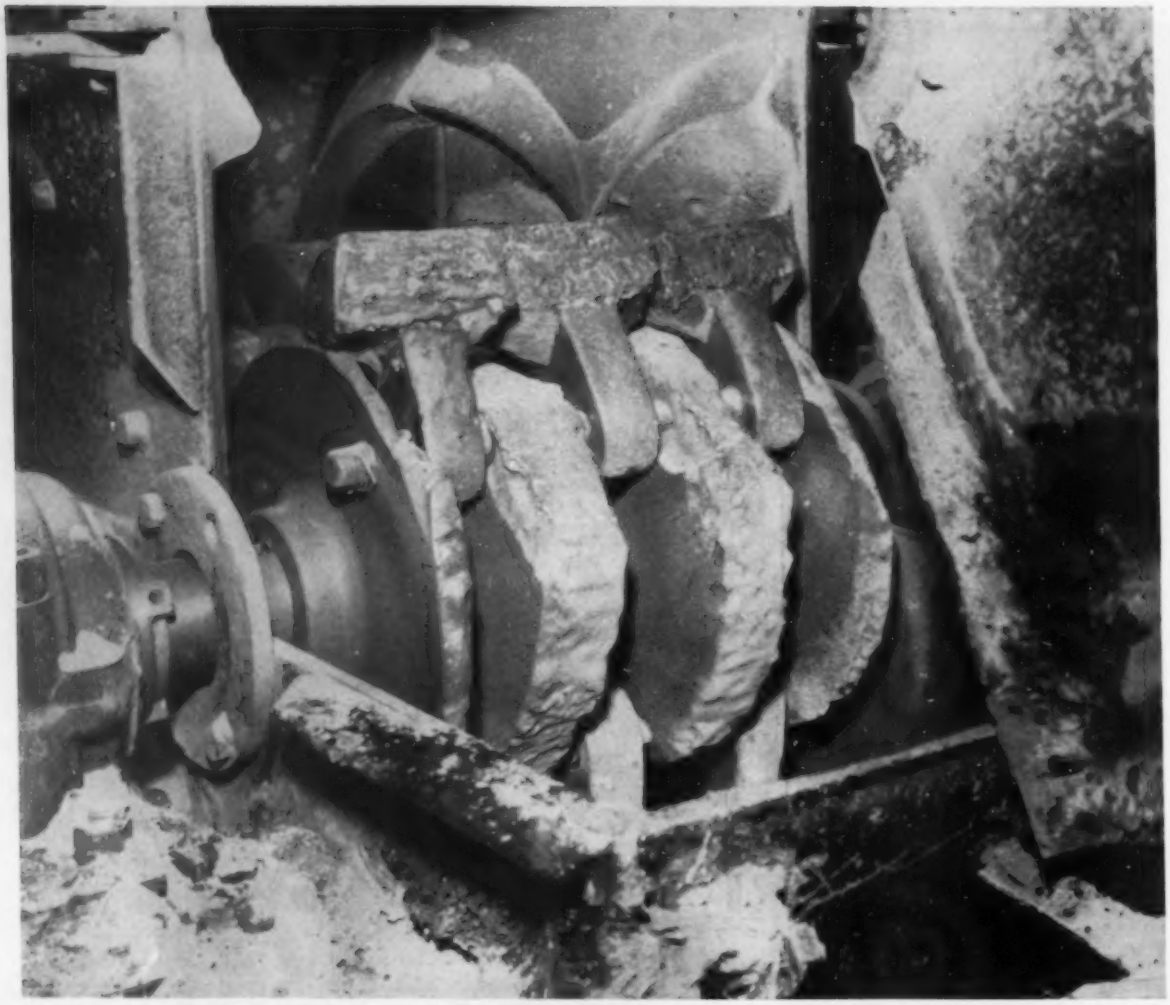
At the same time Chiksan Intelli-Giants operate with much greater speed, safety and efficiency in the slurry preparation because of their ability to traverse areas 120° vertically and 270° horizontally. They may be operated at water pressures ranging from 30 to 300 psi because of the unique full flow internal design of the Intelli-Giant.

WRITE TODAY FOR DETAILED INFORMATION

CHIKSAN CO.
BREA, CALIF.
DEPT. MW-5

CHIKSAN intelli-Giant

CHIKSAN COMPANY • BREA, CALIFORNIA • Chicago 3, Illinois • Newark 2, New Jersey
Well Equipment Mfg. Corp. (Division), Houston 1, Texas
Subsidiaries: Chiksan Export Co., Brea, Calif.; Newark 2, N.J.
Chiksan of Canada, Ltd., Edmonton, Alta.



The periphery of the hammer mill rotor discs pictured here is regularly maintained with Coated Tube Stoodite, a high alloy electrode providing extreme wear resistance.

HOW TO GET MORE FROM YOUR HAMMER MILLS

Crushing decomposed rock and clay to produce material for wet-finished brick is a rough job and mighty tough on mill hammers. The Chattahoochee Brick Company in Chattahoochee, Georgia, has established a maintenance procedure that is producing more material at considerably lower cost by the use of Stoody alloys.

The raw material is dry-crushed in a pair of double rotor hammer mills. The problem, as usual, is to maintain the corners on hammers and keep them out to size as long as possible. The corners and edges of the hammer are, of course, subjected to severe impact and abrasion. At Chattahoochee Brick Company *new* manganese hammers are capped with an overlay of Stoody 21. As corners become rounded and the efficiency of the mill drops off, the hammers are pulled and turned over to the weldor for rebuilding.

Worn hammers as shown in the illustration are brought back to size with Stoody Manganese and the entire wearing area is hard-faced with Stoody 21. Records show that some hammers have been rebuilt and returned to service as much as 20 times. Thus the hard-facing program shows a remarkable saving in replacements as well as in downtime, and produces a greater volume of usable, properly sized particles.

Your Stoody dealer would be glad to advise you on the maintenance of your crushers and other heavy equipment subject to costly wear. Check the yellow pages of your telephone book or write to the company for complete descriptive literature.

STOODY COMPANY
11969 East Slauson Avenue
Whittier, California

VICTORIA—*Wah Chang (Australia) Pty. Ltd.*, a subsidiary of *Wah Chang Corporation* of New York, has opened an office at 450 Collins Street, Melbourne, where it will purchase tungsten, antimony, tantalum, rutile, zircon, and other ores from, or act as agents for, Australian producers. Eventually, plants may be erected in Australia for processing complex ores. For many years, Wah Chang has acted as agent in the United States for *King Island Scheelite (1947) Ltd.* of Tasmania.

REPUBLIC OF THE PHILIPPINES—The Philippine government has acquired 1,600,000 shares of stock in *Lepanto Consolidated Mining Company*. The stock had been purchased, allegedly under questionable circumstances, by two individuals from Japanese interests during the war. The stock was seized by the United States as alien property after the war, subject to eventual return to the Philippine government. Total operating income of Lepanto increased last year by Pesos 2,477,166.66 over 1953. This was due to many factors, among them: an increase of 38,906 tons of ore milled and an increase of 20,326 ounces of gold produced. Ore reserves at the end of the year were 2,789,430 short tons, averaging 4.03 percent copper and 0.153 ounces of gold per ton, as compared with 1953 reserves of 2,695,615 short tons, averaging 4.10 percent copper and 0.157 ounces of gold per ton.

NORTHERN TERRITORY—*Uranium Development and Prospecting N.L.* is forming a separate operating company, *Australian Uranium Corporation N.L.*, to take over its Adelaide River mine. The new firm will hold a one-third interest in Uranium Development's authority to prospect over 195 square miles in the South Alligator River area.

NEW CALEDONIA—Nickel metallurgy is in the process of being revised with a view to lowering costs and increasing capacity of production. The program calls for construction of a hydroelectric plant capable of producing 340,000,000 kilowatt hours, and construction of an electric melting plant designed to produce 10,000 tons per year of ferro-nickel.

REPUBLIC OF THE PHILIPPINES—Philippine gold producers are reported to be facing operating difficulties again as the result of recent price declines brought about by the current confusion over the interpretations of a Central Bank circular allowing the sale of possession of gold in this country. Domestic buyers have been discouraged as a result of "nuisance" raids on establishments suspected of smuggling gold illegally out of the country. The price of the precious metal has dropped as low as Pesos 106 per ounce; the marginal price was set at Pesos 111.72.

QUEENSLAND—*Mount Isa Mines Ltd.* has resumed full scale copper production following repairs to the reverberatory furnace. Current rate is 2,000 tons per month. The company has won a case in the High Court against the Commonwealth government for taxation rebates on money spent in building the town of Mt. Isa over a 23-year period. The amount is estimated at about £A500,000.

NEW SOUTH WALES—*Lake George Mines Pty. Ltd.* at Captains Flat has resumed full-scale production. During the operating period in 1954, improvement in recoveries from the complex lead-zinc-pyrite ore was achieved. A satisfactory agreement for the sale of pyritic concentrate has been negotiated with *Australian Fertilizers Ltd.* at Port Kembla. Lead and zinc concentrate will continue to be exported, while copper concentrate will be treated in Port Kembla. Japanese interests are reportedly interested in a purchase of lead concentrate.

NEW CALEDONIA—The *Nickel Company* of Noumea is reported to have signed a contract with the *Pentecote* group of mines at Kouaiou on the east coast for treatment of 150,000 tons of ore averaging 4 percent nickel metal. The Kouaiou area had been closed, but ore is now being mined from open cuts. The Pentecote group has opened a new mine on the west coast with an estimated monthly output of 5,000 tons of low-grade nickel ore. Ore from the latter operation will go to Japan.

REPUBLIC OF THE PHILIPPINES—In order to place the *Hixbar* mine of *Hixbar Gold Mining Company* on Rapu Rapu Island on a payment basis as soon as possible, the following plan of operation has been recommended: extensive exploration by diamond drilling and underground drifting to prove and increase the present ore reserves at the earliest date; stripping of over burden and excavation of all ores above Level 2, and systematic underground development below Level 2 for future mass production in order to fulfill the *National Power Corporation* contract and the *Pacific Mining Company* contract (see MINING WORLD, January 1955, page 69). The installation of a processing plant was also suggested when the estimated ore reserve is proved after prospecting work on the area between Level 3 and Level 4. Preparations for the stripping operations are now under way, and the mine camp has been moved to a new site to make way for the stripping work. Acting on the suggestion of Paul A. Schafer, consulting geologist, it was decided to postpone the diamond drilling program until the ore at the open pit area is exposed. This work will uncover the structure of the ore body. A better perspective for the drilling program will thus be obtained.

NEW SOUTH WALES—Beach sand mining for zircon-rutile has now extended south of Port Kembla. A subsidiary of *National Minerals Ltd.* will operate a small plant consisting of tables and spirals at Shellharbour. A number of lease applications have now been granted in the Port Kembla-Wollongong area. Present indications are that reserves of heavy minerals are smaller than on the longer established areas in northern New South Wales and southern Queensland. It is anticipated that total output of both rutile and zircon will top existing records this year. Prices remain favorable and despite a tendency for average grades to be reduced, most companies are improving and extending their equipment.

INDONESIA—Japanese representatives are negotiating with Indonesia for an increase in shipments of tin to Japan. The current rate is 100 tons per month. If the Indonesia-United States tin contract is not renewed, the Japanese request probably will be granted.

QUEENSLAND — *Ravenshoe Tin Dredging, Ltd.* at Mt. Garnet will curtail construction work on its dredge following information from the Queensland government that power from the Tully Falls hydroelectric project will not be available

Island Supplies Iron Ore for Australian Mills

Increased iron and steel production at Newcastle and Port Kembla, New South Wales, Australia, is leading to increased quarrying of iron ore at Cockatoo Island in Yampi Sound, 3,000 sea miles away. This 3½-square-mile island off the coast of northwestern Australia is operated by Australian Iron and Steel Ltd., a subsidiary of the Broken Hill Proprietary Company Ltd. 750,000 tons of iron ore are mined here annually. After quarrying, ore is handled by an 8-cubic-yard electric shovel. Diesel-driven, 30-ton Mack trucks transport ore from the quarry down a winding concrete roadway to the primary crushing plant closer to sea level. The top of the plant can be seen in the photo above. The crushed ore drops through the plant to the wharf below, where it is loaded aboard ships for transportation to the eastern coast. Total pig-plus-steel output is now 4,000,000 tons per year.

why gamble
on point performance?

insist on ESCO

TESTED POINTS

for... DRAGLINES
DIPPERS
HOE DIPPERS
CLAMSHELLS
FRONT END LOADERS
DOZER ROOTER
RIPPERS

Self-Sharpening *ESCO* Points are *individually Brinell tested* to be sure they have exactly the correct degree of abrasion resisting hardness for faster digging and longer life.

ESCO

Offices and Warehouses: Honolulu, Hawaii; Houston, Texas; New York, New York; Los Angeles, San Francisco, California; Seattle, Spokane, Washington; Centralia, Pennsylvania; Eugene, Oregon; Salt Lake City, Utah. In Canada: Vancouver, B.C., and Toronto, Ontario.

ELECTRIC STEEL FOUNDRY CO.

2147 N. W. 25TH AVE., PORTLAND 10, OREGON
712 PORTER ST., DANVILLE, ILL.

until the end of 1956. Meanwhile, *Tableland Tin N.L.*, which is dredging in the same area, reports variable monthly outputs of concentrate because of patchy ground. These are from 20 to 70 tons per month.

PHILIPPINE ISLANDS—Molybdenum has never been mined commercially in the Philippines but has been found in a number of places, the most notable being in Nueva Ecija, Batangas, Marinduque, Masbate, Camarines Norte, and in the *Toledo* copper mine on the island of Cebu. While there has been interest in several known deposits and the Bureau of Mines has correlated data on a number of the areas, the only immediate source of production will be from the Toledo. Daily production will be between 400 and 500 pounds. This is a small quantity in comparison with the Toledo's copper output, but it is sufficient to warrant extraction and may eventually form the basis for a new chemical industry in the Philippines.

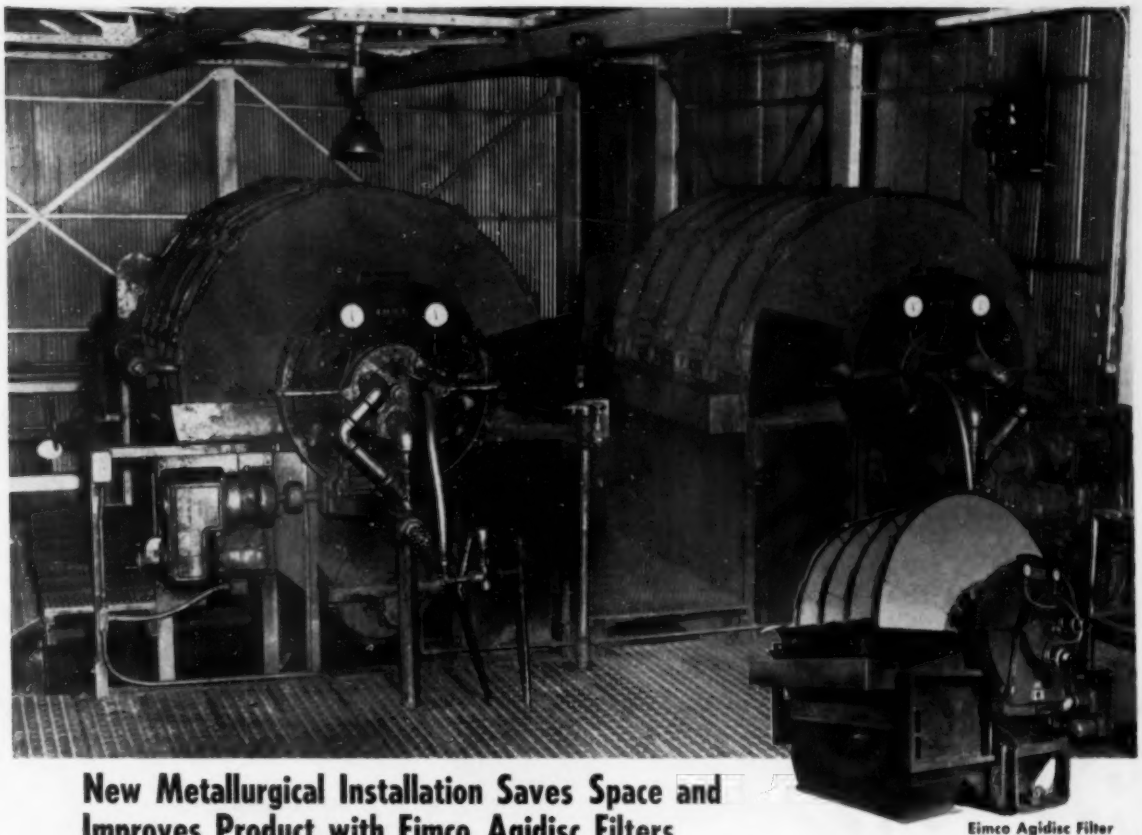
VICTORIA—Aerial reconnaissance surveys of three areas in Victoria will be made this year. The Bureau of Mineral Resources, Geology, and Geophysics will operate in conjunction with the State Mines Department. An Auster aircraft will be used in the hilly eastern part of the state where a heavier plane cannot be used. A Douglas DC-3 will be used east and west of the Grampians Mountains (mainly low and very rocky) in the western part of the state. The Heathcote area, north of Melbourne, will also be examined. Emphasis will be on the search for radioactive indications.

KOREA—The South Korean government offered 300 tons of tungsten for sale in March, or 50 tons more than previous offers. Successful bidders were: 50 tons scheelite to *Metallurg* for $33.20; 200 tons scheelite to *Wah Chang Corporation* for $30.00; and 50 tons wolframite to *Philip Brothers* for $31.50. Both previous offers had gone to Wah Chang.

INDIA—Rajasthan State's second Five-Year Plan will emphasize development of the state's rich mineral resources, particularly copper, lead, zinc, and gypsum. According to the state's chief minister, Mohanlal Sukhadia, there is plenty of gypsum available and erection of a fertilizer plant is planned. Officials are also taking up the question of installation of a zinc smelting plant near Zawar with the Union government.

THAILAND—A Japanese firm, *Mitsubishi Metal Mining Company*, recently concluded an agreement with a Thai firm who owns the *Chiang Pra* mine in Surathami to equip the property. Plans in their final stage call for creation of a joint company capitalized at 10,000,000 bahts. The Thailand firm will furnish the mining rights and other local facilities to the value of 51 percent of the capitalization, while the Japanese firm will provide machinery and other equipment valued at 49 percent.

MALAYA—The No. 2 dredge of *SungeiWay Dredging Ltd.* has been shut down for a four-to-six-month period



Eimco Agidisc Filter

New Metallurgical Installation Saves Space and Improves Product with Eimco Agidisc Filters

The photo above shows an installation of two 6' diameter by 5 disc Eimco Agidisc Filters in their operating position in a new metallurgical concentrating plant.

These filters were installed as a result of the owner company and Eimco cooperation in a joint effort to improve the operation of the filter station at this plant and reduce moistures with the most economical equipment.

After the installation had been operating for six months the following data was made available.

	PREVIOUS EQUIPMENT	NEW EIMCO FILTERS
1. Concentrate handled	350,000 lbs./24 hrs.	350,000 lbs./24 hrs.
2. Labor required	1 man full time	1 man part time
3. Attention required	Constant inspection	Periodical inspection every 6-8 hrs.
4. Operating Capacity	Full load—no capacity for additional tonnage	½-¾ load—capacity for 33% to 100% additional tonnage
5. Equipment	4—Drum filters (not Eimco)	2—6' dia. x 5 disc Eimco Agidiscs
6. Filter area	621 sq. ft.	500 sq. ft.
7. Floor Space occupied	416 sq. ft. filters only	189 sq. ft. filters only
8. Cake Moisture	20%—21%	14%—15%
9. % Moisture reduction over previous method		33%
10. Filter rate increase over previous method		more than 15%

Eimco specializes in equipment to do a better job in filtration. Before you buy, take advantage of Eimco's experience in building filtration equipment for customers who look beyond first cost to get quality construction, individual design and guaranteed performance.

THE EIMCO CORPORATION

Salt Lake City, Utah—U.S.A. • Export Offices: Eimco Bldg., 52 South St., New York City

New York, N. Y. Chicago, Ill. San Francisco, Calif. El Paso, Texas Birmingham, Ala. Duluth, Minn. Kellogg, Ida. Baltimore, Md. Pittsburgh, Pa. Pasadena, Calif. Houston, Texas London, England Gateshead, England Paris, France Milan, Italy Johannesburg, South Africa

B-102

PAN

CONTINUOUS PRESSURE

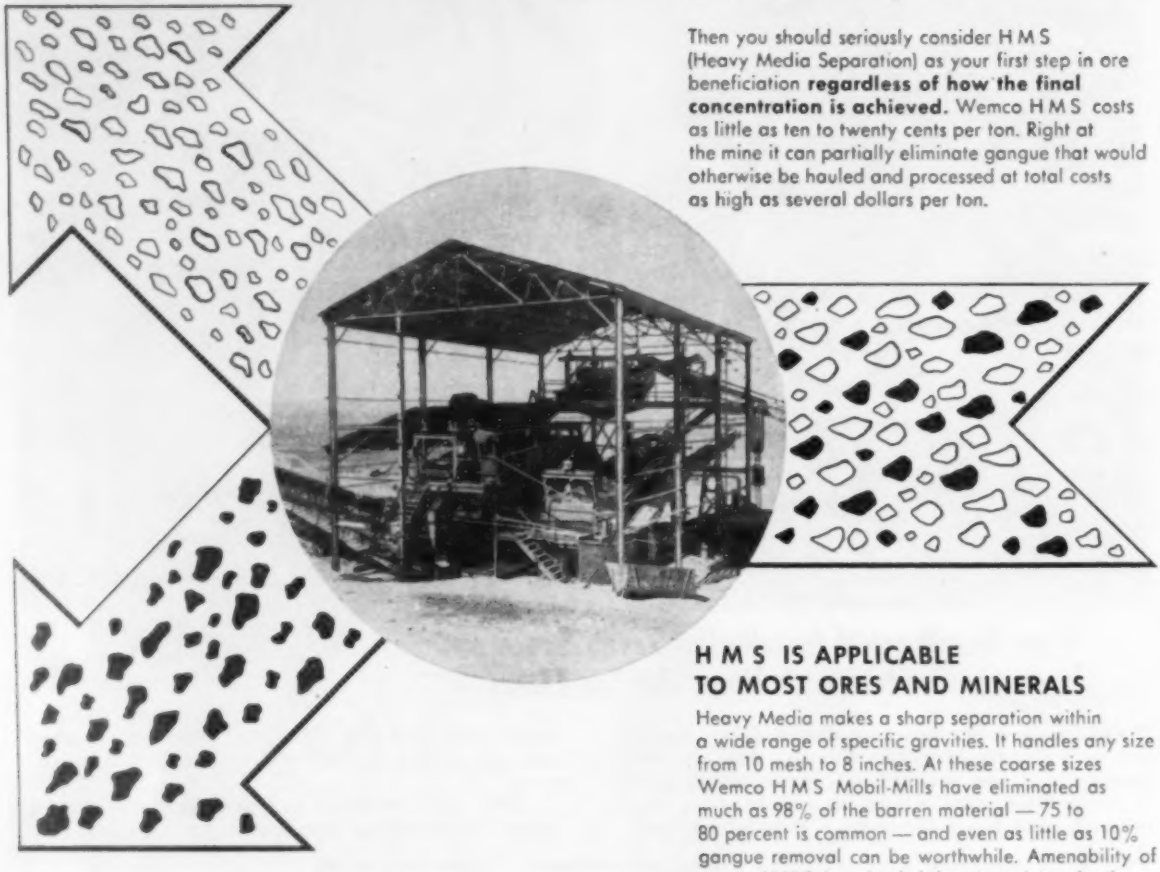
PRESSURE PRECOAT

BI-CARB

PRESSURE ROLL

BURWELL

WOULD YOU SPEND 15¢ to save dollars per ton?



Then you should seriously consider H M S (Heavy Media Separation) as your first step in ore beneficiation **regardless of how the final concentration is achieved.** Wemco H M S costs as little as ten to twenty cents per ton. Right at the mine it can partially eliminate gangue that would otherwise be hauled and processed at total costs as high as several dollars per ton.

H M S IS APPLICABLE TO MOST ORES AND MINERALS

Heavy Media makes a sharp separation within a wide range of specific gravities. It handles any size from 10 mesh to 8 inches. At these coarse sizes Wemco H M S Mobil-Mills have eliminated as much as 98% of the barren material — 75 to 80 percent is common — and even as little as 10% gangue removal can be worthwhile. Amenability of ores to H M S is a simple laboratory determination. Wemco offers this service.

WEMCO'S H M S MOBIL-MILL IS A PROVEN COST SAVER

The Wemco Mobil-Mill is H M S in its most practical form. The cost is predetermined and low because it is a complete plant that is pre-engineered and pre-fabricated. It can be assembled close to the mine (or even underground). And, the Wemco Mobil-Mill is so thoroughly proven in design that it operates from the first day. Mobil-Mills are available to fit your problem exactly. Capacities range from 5 to 500 tons per hour.

WEMCO®
WESTERN MACHINERY COMPANY

DEPT. B-2214, 760 FOLSOM STREET • SAN FRANCISCO 7, CALIFORNIA
50 CHURCH STREET • NEW YORK, NEW YORK
129 ADELAIDE STREET WEST • TORONTO, CANADA
20 BOULEVARD MALESHERBES • PARIS (8e), FRANCE
Representatives in principal cities of the United States and Canada and in major countries throughout the world.

Wemco has built over 50% of all the H M S plants in use today. This experience can help you. Wemco welcomes your inquiry.

while it is being converted from steam to electricity. This is expected to effect a substantial saving in operating costs. All three dredges will then be electrically operated and further economy should be experienced once the company will be in a position to obtain electric current from the Electricity Board which is now waiting to take over a newly erected power plant.

BURMA—The Burma Government Mineral Resources Development Corporation reports that large manganese deposits have been found in Hopong State 12 miles due east of Taunggyi, Southern Shan states. First opened in 1952, some 20,000 tons of manganese have been exported to the United States, United Kingdom, and other countries in Europe. A 250-foot shaft has been sunk on the deposit. Further geological and geophysical prospecting are being carried out and indicate that the manganese and deposits are widespread and valuable.

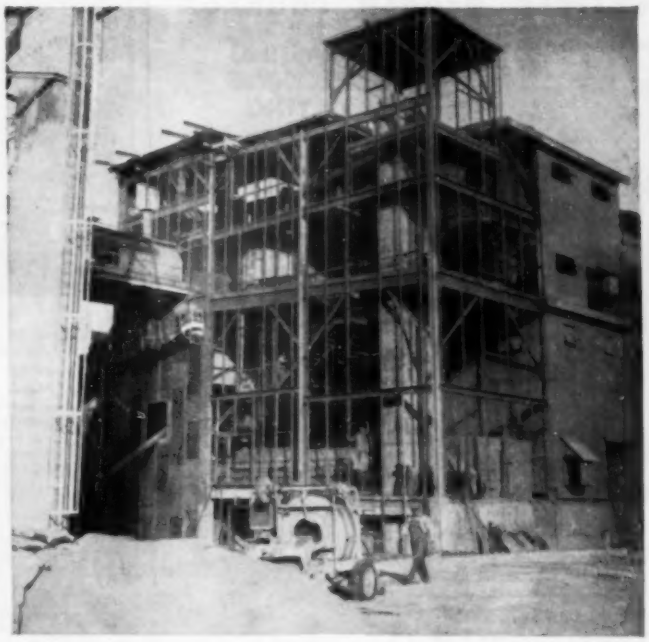
MALAYA—The biggest tin prospecting survey in Malaya since the war is almost finished. Teams representing more than a dozen European and Chinese mining companies have been working since May 1954 under the protection of Area Security Units in a 30-square mile area of the Kroh forest reserve in south Perak. There was a chance that the area might be valuable because it is immediately south of the mining areas of the Kinta Valley; however, the Chief Inspector of Mines reports that results to date have been disappointing.

INDIA—The government is reported to be considering a Rupees 4-crore plan for the expansion of the Geological Survey of India during the next five years. The number of trained geologists would be increased from 150 to nearly 400; laboratory and field equipment would be modernized; and nearly half of the country, yet uncovered by any survey, would be mapped on a one-inch-to-one-mile scale. The government also proposes to reduce the number of circle offices from five to three. This would mean merging the circle offices in Bombay and Madras with the one at Hyderabad, while the other two at Lucknew and Calcutta would be continued. Calcutta is presently the headquarters for the director of the Geological Survey. The government is said to be considering raising that position to the status of director-general, and in this event the government would be desirous of having the headquarters moved to Delhi so that the official would be available for consultation.

ISRAEL—The chairman of the Israel Atomic Commission is reported to have announced the discovery of a cheap way of extracting uranium from phosphate deposits, as well as a new method of making heavy water. The uranium method is said to have been tested in a pilot plant. The method of producing heavy water without the use of electricity has been carried out on a laboratory scale. The results raise hopes of using the method to compete with the electolytic method.

MALAYA—*Malayan Gold Mining Company Ltd.* is still waiting for government approval to resume prospecting of about 1,150 acres at Batu Bersawah between Bahau and Rompin in Negri Sembilan. The region is still not considered safe enough to permit entry for inspection or prospecting. The firm considers it has

110 ADDED BARRELS PER HOUR



Enlarging and modernizing the grinding room of this large cement plant provided a *gain in finished product* which far outweighed the costs involved.

Consult Stearns-Roger as to how to eliminate "bottlenecks" and increase both your plant production and efficiency.

Gunite...one of many modern types of wall construction employed by Stearns-Roger in buildings which house industrial plants.

COMPLETE NEW PLANTS OR ADDITIONS TO EXISTING STRUCTURES

Undivided Responsibility

- ENGINEERING
- MANUFACTURING
- DESIGNING
- CONSTRUCTION

Stearns-Roger

THE STEARNS-ROGER MFG. CO. DENVER, COLORADO

PACIFIC FURNACE

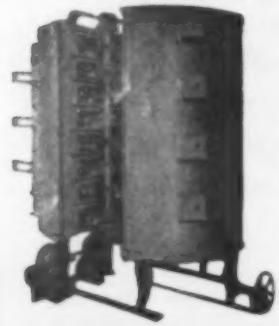
MULTIPLE HEARTH FURNACE

SIZES 8' 6" TO 22' 3" DIAMETER
NUMBER OF HEARTHS, 1-16

ROASTING
CALCINING
DRYING

ZINC ORES	QUICKSILVER
IRON ORES	MAGNESITE
COPPER ORES	LIMESTONE
TIN ORES	MOLYBDENUM
NICKEL ORES	BONE CHAR
LEAD ORES	DIATOMITE
SODA ASHES	LIME SLUDGE
FULLERS EARTH	MAGNESIUM
CARBON	CLAY GRANULES
PYRITE	ANTIMONY

SELENIUM
SEWAGE SLUDGE
LEAD CHEMICALS
METALLIC SLUDGES
FILTERING MEDIA
And for Numerous Other Materials



Pacific Laboratory Furnace

PACIFIC LABORATORY FURNACE

Manufactured in two sizes—36" and 54" inside diameters having 6-8-10 Hearths and include the same features as the commercial size furnace.

Pacific Furnacing Unit

NEW PACIFIC FURNACING UNIT

Higher shell height. Three gas burners. Provision for conversion to muffle unit. Small volume roasts at any desired temperature.

PACIFIC FOUNDRY COMPANY LTD.
Engineers and Metallurgists

1400 So. Alameda St. Los Angeles | 3100 19th St. San Francisco | 551 Fifth Ave. New York

WHEN THE GOING IS TOUGH IT'S A PUSHOVER WITH....

HENSLEY

Added life — greater economy from Hensley's special analysis steel Cutting Edges . . . whether you're biting and moving dirt, shale, rocks, gravel or hard-packed snow!

Hensley Cutting Edges are precision punched to fit all kinds of earth-moving equipment, and may be ordered plain or hard-faced to suit your special needs! Contractors are learning they can depend on Hensley Cutting Edges—just as they depend on Hensley dozer rippers, scraper rippers, bottom track rollers, scarifier points and many other items in complete stock at your nearby Hensley dealer!

Write for the name of your nearest **HENSLEY** Dealer

Some Dealer Territories Open

HENSLEY TRADE MARK EQUIPMENT COMPANY, INC.
800 PERALTA AVENUE • SAN LEANDRO, CALIFORNIA

FLEXCO® BELT FASTENERS and RIP PLATES

FOR HEAVY CONVEYOR AND ELEVATOR BELTS OF ANY WIDTH

Compression Grip distributes strain over whole plate area

★ FLEXCO Fasteners make tight butt joints of great strength and durability.
★ Trough naturally, operate smoothly through take-up pulleys.
★ Distribute pull or tension uniformly.
★ Made of Steel, Monel, Stainless, Everdur. Also Promal top plates.
★ FLEXCO Rip Plates are for bridging soft spots and FLEXCO Fasteners for patching or joining clean straight rips.

Order From Your Supply House. Ask for Bulletin F-100

FLEXIBLE STEEL LACING CO.
4615 Lexington St., Chicago 44, Ill.

about $1,000,000 invested in the project. For these same reasons no other gold mining projects have been undertaken in the region, and the country's only producer last year was *Raub Australian Gold Mining Company* with 21,000 troy ounces.

BURMA—Estimated ore reserves at the *Mawchi* tin and tungsten mine are now 616,500 tons containing 1.54 percent tin and 0.75 percent tungsten. The mine is located in the Southern Shan States and has been on a care and maintenance basis since 1948 when the mine was occupied by the Karen rebels. It was liberated in November 1953 by Burmese National Forces. A comprehensive survey made by the technical managers, *New Consolidated Goldfields Ltd.*, during the period from March to May of 1954 brought recommendation for a £450,000 program to bring the mine back into production. The downward trend in the values of ore reserve blocks below the fourth and fifth levels is not considered to be encouraging, but it is considered possible that exploration at current horizons will reveal more ore. To attain the 1948 milling rate of about 3,000 tons per month, which is now considered to be the initial target, at least one year's work will be necessary. This also depends greatly on the company's ability to recruit and train an entirely new labor force. In 1939 nearly 161,000 tons of ore (the plant's full capacity) were milled from which 5,564 tons of mixed concentrate were produced.

BRITISH COLUMBIA—A newly formed subsidiary, *Saguenay-Kitimat Company*, has been awarded the contract for expansion of *Aluminum Company of Canada's* facilities at Kitimat. (See MINING WORLD, February 1955, page 80 for proposed expansion plans.) *Aluminum Limited* is parent company of both firms. Work has started on construction of a fourth generator of 140,000 horsepower for the Kemano powerhouse. The additional facilities, expected to go into operation early in 1956, will increase production capacity for primary aluminum by 60,000 tons annually.

ONTARIO—A fire in the No. 3 booster pump station of the *Errington* mine's dredging plant destroyed the enclosing frame building and electrical equipment, reports *Steep Rock Iron Mines, Ltd.* The booster station handles material from the "La Seine" dredge and discharges it into the west arm of Steep Rock Lake. A three-month delay followed while repairs were being made.

MANITOBA—The *International Nickel Company of Canada, Ltd.* is investigating a nickel-bearing ore body in the Mystery Lake area adjacent to Moak Lake. Extensive surface drilling has been carried on, and a program of underground exploration and drilling is being undertaken. A 1,300-foot shaft is to be sunk, followed by 10,000 feet of crosscutting and drifting at an estimated cost of $2,000,000.

QUEBEC—Shaft deepening has been started by *Bevcourt Gold Mines* to open four new levels below the present bottom at 1,600 feet. The company hopes to improve its ore reserves which, on December 31, 1954, were estimated at 316,203 tons averaging 0.132 ounces gold per ton. Initial drilling indicated the same type of ore as that presently being mined. Normal mining operations will continue, with a new stope currently being prepared on the 1,150-foot level. The mill currently handles 740 tons of ore per day. Bevcourt's property is in the Val d'Or district.

ALASKA—The *Uraluck Exploration Company* has filed 48 uranium claims on the Kenai Peninsula. Richard H. Alvord represented the firm in the filing.

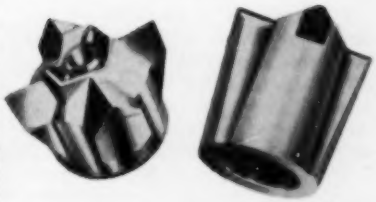
ONTARIO—*Caland Ore Company* will start its big dredging program this season in the Falls Bay portion of Steep Rock Lake. Two dredges are now being constructed for this job. Both dredge hulls are in the water and work is proceeding with the superstructure and machinery installation. The dredging program will remove 160,000,000 cubic yards of clay overlaying the iron ore body. Already about $7,500,000 has been spent of an estimated $50,000,000 total cost for the project.

ALASKA—The *Livengood Placers, Inc.* ground is being mined by Glenn Franklin, Chuck Herbert, and associates on Livengood Creek. The men are using a dragline instead of a dredge. Livengood Placers' equipment was sold by the RFC last fall to the *U. S. Smelting Refining and Mining Company*. Apparently the firm retained title to the ground.

LIDDICOAT

Used-to-destruction • no resharpening

the bit for fast feed leg drilling



LIDDICOAT BITS

. . . and feed leg drilling machines . . . you just can't beat this speedy, cost cutting combination! Designed for efficient, low cost operation, Liddicoat is the bit that is used-to-destruction and then discarded . . . no resharpening . . . no delays . . . no extra costs . . . the ideal bit for easier drilling with feed leg machines.

LIDDICOAT TEE CEE BITS

. . . as shown at right above, is a tungsten carbide insert bit designed for on-the-job interchange with Liddicoat used-to-destruction bit . . . both fit the same drill steel. Now, you can switch to the most economical bit — right on the job — on the same steel — to meet varying ground requirements. No delay whatever!

NO THREAD SOCKET . . . The socket of the Liddicoat Bit is accurate to thousandths of an inch . . . precision that means a stronger connection and longer bit life. Of prime importance is the strong attachment without threads. Forged within the socket of the bit are flats between the rounds. Any turning of the rod within the socket tends to lock the bit tightly to the rod, yet is easily removed. For details, write us or call a reliable Liddicoat dealer.

The most popular bit for roof bolting.

WESTERN Rock Bit Manufacturing Company

552 West 7th South • Salt Lake City 4, Utah

Assays in 1954 of Representative Smelter Charge, Flux, Slags, and Blister Copper at O'okiep Copper Company, Ltd.'s Copper Smelter, Nababeep, Union of South Africa

Material	*% Cu*	*% S*	*% SiO_2*	*% FeO*	*% Al_2O_3*	*% CaO*	*% MgO*
Nababeep concentrate	32.67	13.82	23.54	15.56	4.26	1.38	8.56
O'okiep concentrate	28.37	28.05	6.56	36.56	4.30	1.12	0.56
Nababeep precipitate	58.89	2.16	3.86	10.72	6.03	0.24	0.47
Reverberatory slag	0.42	0.52	38.40	43.47	11.19	1.56	3.59
Converter slag	6.00	2.33	20.92	62.12	5.69	0.06	0.15
Matte	40.06	25.51	0.16	30.14(Fe)	1.31	—	—
Barren sand	—	0.03	79.74	2.64	11.50	0.20	0.09
Flue dust	54.76	12.78	10.52	11.89	4.20	0.54	0.23
Boiler ash	5.34	0.17	45.94	13.03	28.32	2.84	1.23
Coal ash	—	—	50.60	6.02	35.43	3.08	0.99

	% Cu	*% Ins*	*% S*	*% Fe*	*% Ni*	*% Se*	*% Te*	*% As*	*% Bi*	*Ozs/ton Au*	*Ozs/ton Ag*
Blister copper	99.145	0.008	0.038	0.005	0.496	0.031	0.029	0.0005	0.0001	0.065	3.79

O'okiep Smelter

(Continued from page 54)

cally turns out if the air pressure drops below seven pounds per square inch.

The mouths of the converter are 45 square feet and are lined with a cast steel collar. A collar puller of local design is used to clean the mouth. If the accretions are kept hot, the collar puller works well; otherwise trouble is encountered with the cast steel sections. While holding a converter for casting of copper, coal is furnished from the pulverizer with the aid of a 350-cubic-foot-per-minute single inlet fan.

Converter air is furnished by two turbo-blowers, one 10,000 (intake) and one 5,000 cubic feet per minute (intake). Air pressure at the converters is 12 to 13 pounds per square inch. With the two blowers there is only sufficient air for one converter operation.

The latest development in converter practice has been mechanical tuyere punchers. After nine months experimenting, both converters are being completely equipped for mechanical punchers. Mechanical punching has shown a definite advantage over hand punching as follows:

(1) Better blowing time with no loss of air due to bleedbacks; (2) less labor; (3) less steel consumption; and (4) better refractory life.

Converter flux is sand gathered from the veld. This is charged by boat from the crane to the converters. It is not an ideal flux as the silica-to-alumina ratio is too low. Experimental work with quartz added indicates a definite improvement and will probably be used in the near future.

Most of the reverts are resmelted in the converter with only a smaller tonnage being returned to the furnace for bridgewall protection.

An unusual departure from regular practice is that all precipitates from the leaching plant are smelted directly through the converters. Up to 400 tons of copper from precipitates in one month has been obtained in this way. Normal production is 200 tons.

The converter aisle is serviced by one Pawling and Harnischfeger crane with a 45-ton main hoist and two 15-ton auxiliaries travelling on the same carriage. The crane cab is completely air-conditioned with a Lintern aire-rectifier which cleans the gases with a screen filter and neutralizes the SO_2^- fumes with activated charcoal filters. Not only has maintenance cost been low, but the benefits gained have been great.

The matte and converter slag are handled in 90-cubic-foot ladles. Ladles are protected with slag shells when tapping matte and pouring copper. Upon failure of a bottom of a ladle, a four-inch disc is welded in its place. Ladle consumption has been low with only 12 being purchased during the entire operation and all of these can still be used.

Casting

The casting equipment consists of a ladle tilting quadrant operated by a hydraulic ram, a 22-foot Walker-type casting wheel, and two 2-ton electric hoists with motor driven monorail trolleys.

During the period of casting the first ladle of copper, the converter serves as a holding furnace for the remaining copper. This works well where there is ample converting time. Under present operating conditions it means the loss of around three hours a day in converting time. Either bigger ladles or a holding furnace will eventually be installed here.

An average charge of 26 tons of blister is cast in 90 minutes. Blister bars will average 350 pounds. Blister copper normally produced will assay 99 percent Cu, with 0.5 percent Ni as the main impurity.

The copper after being removed by the 2-ton hoist is cooled, finned, weighed and sent by truck to Bitterfontein for railage to Cape Town.

Personnel

The normal European complement, including maintenance men, is 20. Operation of the waste-heat boilers is under the power station. The native labor force varies between 150 and 160.

Summary of Smelting Operations at O'okiep Copper Company, Ltd. Nababeep, Union of South Africa

	NEW METAL-BEARING MATERIAL, TREATED — TONS			*COAL USED — TONS*		*REVERB SECONDARIES — TONS*						*CONVERTER TREATED — TONS*							
Date	*% H_2O*	*Dry Tons*	*% Cu*	*Reverb.*	*Converter*	*Conv. Slag*	*Reverts*	*Boiler and Flue Dust*	*Sand Flux*	*Coal Ash*	*Lime Rock*	*Matte*	*Sand Flux*	*Quartz*	*Misc.*	*Matte Grade % Cu*	*Reverb Slag Tons*	*% Cu Slag*	*Blister Production*
1953																			
July	11.4	8,128	29.58	2,290	58	3,886	137	162	435	382	—	5,784	978	—	477	36.1	5838	0.38	2,387
Aug.	11.5	7,330	27.72	2,286	54	3,973	162	166	644	383	—	5,413	938	—	425	33.0	5630	0.44	2,024
Sept.	12.1	7,462	28.76	2,270	00	3,463	129	187	531	387	—	5,120	674	94	419	36.1	5002	0.44	2,118
Oct.	11.8	8,078	28.17	2,294	52	3,937	117	185	549	396	94	5,478	986	152	527	35.3	5701	0.41	2,251
Nov.	12.3	7,487	28.18	2,137	52	3,630	132	160	484	345	19	5,045	920	131	451	36.1	5288	0.43	2,095
Dec.	12.8	8,141	28.83	2,398	59	4,402	62	169	480	349	99	5,962	1,501	55	333	35.3	6514	0.48	2,320
1954																			
Jan.	12.0	7,424	29.79	2,308	73	3,659	111	177	571	350	144	5,309	1,040	35	408	36.0	5478	0.50	2,182
Feb.	12.0	7,128	31.51	2,062	68	3,312	117	115	554	302	130	5,067	816	94	399	38.6	4930	0.48	2,217
March	13.0	7,839	31.07	2,283	68	3,836	113	120	586	330	103	5,835	1,070	—	303	38.1	5615	0.44	2,416
April	11.6	8,076	29.50	2,294	66	3,620	115	124	542	357	—	5,543	981	14	316	38.7	5718	0.40	2,359
May	11.6	8,835	30.15	2,287	65	4,041	135	130	492	358	—	6,188	1,042	15	440	40.1	6203	0.42	2,635
June	11.6	8,855	29.00	2,200	65	3,900	120	120	500	320	—	6,200	950	15	400	38.5	6100	0.45	2,520

MANITOBA—A minimum of 7,000 feet of diamond drilling has been contracted for *Nickel Lake Mines*, subsidiary of *God's Lake Gold Mines*, at Barrington Lake in northern Manitoba. Drilling will test an anomaly indicated by a survey completed last fall. At God's Lake's *Lynn Lake* property, drilling has resumed this season in an attempt to extend a copper ore zone indicated by drilling late last year.

ONTARIO—*Atlin-Ruffner Mines* has purchased a rare earth property of 62 claims in the Parry Sound-Sudbury area. Specimens sent to a firm in the United States for identification and assay reportedly indicated it was a high-grade showing. A program of prospecting and drilling is planned.

BRITISH COLUMBIA—*Beatrice Mining Co., Ltd.* is planning extensive diamond drilling at its property near Camborne to test the Beatrice lode at depth. The main ore body has been partly opened to a depth of about 200 feet below the outcrop and a third adit level is a short distance from the ore zone at 200 feet greater depth. Values are in gold, silver, lead, and zinc. Walter Scorgie is mine manager, and B. W. W. McDougall is consulting mining engineer.

ONTARIO—*Canadian National Railways* has been operating sleigh trains, equipped with radio, to supply construction crews at the copper site near Manitouwadge where buildings and shafts are being erected. These sleighs are hauled by Caterpillar tractors over a road running parallel to the new CNR branch line under construction, and will continue until the spring break-up. *Geco Mines* and other copper projects are responsible for the recent rapid growth of the area.

BRITISH COLUMBIA—*Hixon Placers, Inc.* will resume operations in the Cariboo mining district as soon as weather permits. During their last season (May to December 21), approximately 50,000 cubic yards of material were hydraulicked from the operating pit, including the removal of trees, logs, roots, etc.; a road was partially regravelled; and other development work was carried out. A survey was made for the purpose of grading a higher hydraulic pipe line right-of-way into the pit, which will offer a fall of about 200 feet for the head of water, and a contract was let for the bulldozing work. The company plans with the use of this higher head of water to be able to hydraulic an appreciable yardage throughout the new season. Harry W. Hargood is president.

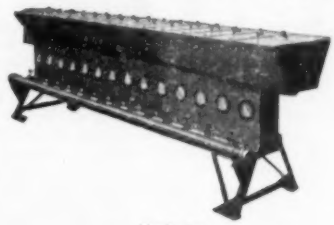
ONTARIO—*Ontario Pyrites Company* will spend $100,000 per month on exploration and development work over the next 18 to 20 months, according to present plans. Object of the program is to double indicated ore reserves at the *Errington* and *Vermillion* mines and in surrounding areas. The company has voted to change its name to the *Consolidated Sudbury Basin Mines*.

NOVA SCOTIA—The *National Gypsum Company* has ordered two 15,000-ton cargo vessels built to the company's specifications in Emsden, Germany. The company says they will be the largest ever operated for the gypsum industry and will be used to transport gypsum rock from the new quarry near Halifax to plants at New York, Baltimore, and Savannah. The first vessel is to be delivered in November and the second in

E. A. GODOY & CO., INC.
CUNARD BUILDING, 25 BROADWAY
NEW YORK 4, N. Y.

CHROME ORES • Refractory • Metallurgical • Chemical
MANGANESE ORES • Metallurgical • Chemical
IRON ORES • Open hearth • Blast furnace

CONCENCO® Type "CPC" Classifier



Made by
"The Original Deister Company"
Incorporated 1906

This all steel Constriction Plate Classifier is available in 1 to 10 or more cells. Novel secondary classification sharpens the separations made by each main cell. Advantages offered are: (1) Accurate classification or sharp sizing, (2) Easy and effective hydraulic water regulation, (3) Each cell produces an accurate spigot product, (4) Continuous discharge, (5) No moving parts, and (6) Low maintenance cost.

The DEISTER CONCENTRATOR CO. 923 Glasgow Ave., Fort Wayne, Indiana

You dig Pay Dirt
with SAUERMAN MACHINES

1½ cu. yd. Sauerman Slackline digs about 100 tph. of soft lead ore.

because

2 cu. yd. Sauerman Scraper reclaims 90 tph. from zinc mine chat pile.

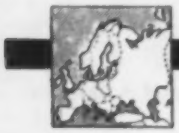
sand, gravel, ore or other bulk materials become pay dirt when the cost of handling is only a few cents per cubic yard.

One man operates a scraper or slackline cableway—reaching out 1,000 feet or more—across pit, pond or stockpile—to dig, haul and load. You eliminate the power costs of moving heavy machinery about the area. You pay only for pay loads—not dead weight. When expendable parts—sheaves, clutch or brake linings—are replaced, the machine is restored to practically new condition.

Find out how the Sauerman Method can be used on your job to give you the lowest cost per cu. yd. handled. Write for Catalog A, Drag Scrapers, Catalog C, Slackline Cableways. Request Field Reports showing your material being handled by the low cost Sauerman Method.

SAUERMAN BROS. INC.
638 S. 28th Ave. BELLWOOD, ILLINOIS

February 1956. They will be owned by an English concern and will be chartered by National Gypsum on a long-term lease.



SWEDEN—The Swedish parliament will consider a bill providing for nationalization of the largest iron ore mines and deposits in Scandanavia, if present plans are carried out. A government commission recently recommended that the government, which already owns 50 percent of the joint stock of the *Loussavaara-Kiirunavaara* mining company, exercise its right to purchase the remainder of the stock from the *Grangesberg* company. It further recommended that the transaction be completed by September 30, 1957, for an equivalent of $188,224,000. Reason for the nationalization is said to be the grave social complications that will arise when the deposits are exhausted.

AUSTRIA—Possibilities of mining tungsten ore in Salzberg province will be studied this summer when geological work started during World War II will be resumed at the Schellgaden site near Lungau. Three disadvantages exist in mining of these deposits: the structure of the deposit is small and scattered; it is a considerable distance from good transportation facilities; and it is located at high altitude—4,500 feet.

ITALY—Mercury is one of the substances which has come up for special attention by the government in the fiscal measures recently decreed to meet extraordinary expenditures. The excise tax on metallic mercury has been fixed at $51.20 per flask; alternatively, if mercury is sold or removed from the mine in form of ore, matte, or concentrate, the duty is 58¢ per pound of contained metal.

BELGIUM—A new uranium agreement replacing one signed in 1944 is now being negotiated by the Belgian government with the United States and Great Britain. The new agreement would cover both quantity and price of uranium to be supplied the U. S. and Britain from the Belgian Congo. In return, the United States would provide aid for the "atomic industrialization in Belgium" including erection of a nuclear plant in Belgium.

PORTUGAL—*Mines et Industrie*, S.A., owner of the pyrite deposits of *Louzal* and *Serra de Caveira*, reports an output of about 200,000 tons from its mines in 1954. The crude ore contains 47 to 49 percent sulphur and about 1 percent copper. The mines have been modernized in the last five years and have an optimum capacity of 300,000 tons per annum. Of the company's present output, one-fifth is for home consumption and the remainder for export. Mine deliveries are transported by rail to the port of Setubal, about 60 miles away. The company's Caveira mine, though fully developed, is not at present producing. Its capacity is about 100,000 tons of pyrite annually.

SWEDEN—The *Stallberg Company* has started production on a small scale at the *Forsby* mine at Skedvi. The main shaft is now down to about 3,000 feet, probably the deepest metal mine shaft on the European continent. At *Tuna Hastberg*, a new main shaft has been completed. A new shaft house with crushing plant and other surface buildings has been started.

POLAND—A trade agreement signed between Poland and Bulgaria provides for the delivery of ores, zinc concentrates, and pyrites to Poland, for which Bulgaria will receive, among other items, products of the Polish mill industry.

AUSTRIA—The *Bleiberger Bergwerks Union* plans to open an antimony mine near the existing Soviet-controlled *Schlaining Mining Company*, where the Union holds exploration rights. No date has been fixed as yet for mining operations to start.

SWEDEN—*Fagersta Steel Works* has started extensive exploration for raw material sources. Modernization has been carried out at the company's mines, and the new mill at Rudgruvan is in production. The company is the main stockholder in the *Dannemora Company* and a new plant is under construction there.

ITALY—The *Texas Gulf Sulphur Company* is reported to be negotiating with the Sicilian Regional Government for a large concession where the company proposes to carry out extensive geological surveying.

BULGARIA—The Bulgarian state plan for 1955, as presented by the official Bulletin of the President of the National Assembly, states that "major attention is

COLUMBIAN ALL-METAL BUILDINGS

Strong • Fire Safe • Low Upkeep

Columbian All-Metal Buildings are increasingly popular with the mining industry because of their unlimited utility value—for warehouses, engine houses, dryhouses, shops, garages, compressor houses, etc. Prefabricated from quality steel. Sectional construction assures easy, low-cost erection. Exceptionally weather-tight. Rigid, strong, fire-safe. Minimum upkeep. Order from distributors listed below—or write direct for complete information.

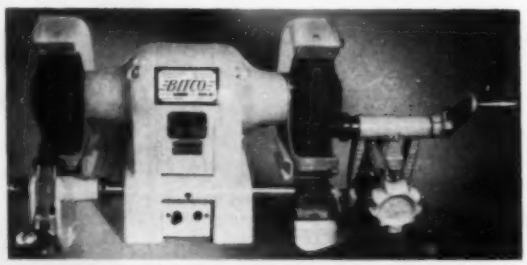
COLUMBIAN STEEL TANK CO.
P. O. Box 4048-H, Kansas City, Mo.

Distributors in the United States

Denver Equipment Company
1400 Seventeenth Street
Denver, Colorado

Elmco Corporation
34 South 4th West Street
Salt Lake City, Utah

Distributors—Foreign
Avenida Ejercito Nacional 438-D
Colonia Chapultepec Morales
Mexico, D. F.



Carbide Insert Rock Bit Grinder

Grinder complete with fixtures to handle average bit dressing requirements of mining and contracting firms.

Your own personnel can dress a bit back to almost new appearance and efficiency. Improve bit life and drilling speed.

Fixtures also available without ¾ HP grinder for mounting on grinder units you already have.

Write for Catalog

BITCO, INCORPORATED

Wallace, Idaho
Box 929

Spokane, Wash.
E. 2928 Trent

Cardin, Oklahoma
Box 225

Helena, Montana
Box 914

BITCO SALES AND SERVICE, Ltd.
908 Front St., Box 129, Nelson, B. C.

After TWO years of field-testing, here's the

NEW IMPROVED TIREX CORD

- *It's more flexible than ever before!*
- *It has greater pliability when cold!*
- *It's much easier and faster to machine-strip!*

New TIREX CORD retains its Selenium Neoprene Armor for added toughness.

New TIREX CORD is still cured in lead to make it smoother, denser and more uniform.

Simplex TIREX

The New TIREX is the most supple, limber TIREX Cord ever made!

Find out more about the New TIREX CORD. Write to the address below for Folder 1022 today.

SIMPLEX WIRE & CABLE CO., 79 Sidney St., Cambridge 39, Mass.

is our

SPECIALTY

Now stripping an average of 1,000,000 tons per month. The Isbell organization has moved over 200 million tons in this and similar operations with a team well trained and experienced in know how.

ISBELL experience in open pit MINING

Isbell experience in volume earth moving and selective open pit mining is long established. Isbell has the equipment, engineering, management, and operating personnel for jobs anywhere.

NOW OPERATING IN: ARIZONA, CALIFORNIA, NEW MEXICO, NEVADA, WASHINGTON

ISBELL CONSTRUCTION COMPANY

P. O. Box 2351, Reno, Nevada, Telephone 3-7135

INTERNATIONAL

to be paid especially to the ore mining industry." This is interpreted by many to indicate that the import of Soviet and Albanian ores did not quite satisfy the requirements of the Lenin Works, Bulgaria's only iron and steel mill.

ENGLAND—A small uranium mine is reportedly being opened at Wheal Bray on Bodmin Moor, Cornwall.

SWEDEN—Systematic lead prospecting using modern electromagnetic methods is now being carried out in Osterlen, southern Sweden. The area is about three square kilometers in size and is owned by the *Brantevik's Mining Company*.

ITALY—The *Montecatini Company* reports that its exploration work in the area around Cuneo (Piedmont) gives every indication of the existence of uranium but that the metal content appears to be too small to merit commercial development. Pitchblende was found at lower depths, and the surface area contained autunite and torbernite. The exploration work was conducted primarily at Riofreddo and Pradeboni at a cost of several hundred million lire.

ENGLAND—A considerable amount of work has been done by the *Weardale Lead Company Ltd.* in reopening the *Wolfcleugh* and *Barbary* mines in Durham. Both of these mines came into production in the latter part of 1954, but full output has not yet been reached. In an attempt to get better recovery of both lead and fluorspar, it has been decided to add a small flotation plant to the ore dressing facilities. This plant should be in operation by the middle of this year, and is expected to broaden the potential market for the company's products. During the year which ended September 30, 1954, 12,906 tons of crude ore were produced by the company, resulting in a recovery of 433 tons, as compared with 496 tons in the previous year. Known reserves of spar have fallen to 6,000 tons, but it is estimated that there should be a marked improvement now that the Wolfcleugh and Barbary mines are in production.

BULGARIA—The first lead-zinc smelter in the country is reported to be under construction in the eastern Rhodope, a mountainous region in the southern part of Bulgaria. The plant will be supplied with ore from the Rhodope mining basin, and will produce, among other products, electrolytic zinc. Operations are expected to begin late this year.

LATIN AMERICA

MEXICO—The *Banco Nacional de Mexico, S.A.* has forecast that at least 1,000,000 tons of Mexican mined sulphur will be exported this year. *Cia Azufrera Mexicana S.A.* started it off with a shipment of 3,500 tons from a dome at San Cristobal near Minatitlan, Vera Cruz to the National Sulphuric Acid Association in London, England. Azufrera has already supplied local industry with more than 10,000 tons this year. The port of Coatzacoalcos, through which the European export was made, is cooperating with sulphur mining companies in its area by deepening the harbor to 40 feet and pro-

it's yours—all yours

Kleenslot

WEDGE WIRE MAKES MARCEL-TYPE SCREENS FOR

DEWATERING
SIZING
AND SCREENING
OPERATIONS

This screen has a marcel type of construction. Specially designed for rough and abrasive type of materials, gives long life, non-blinding operation and still presents a flat surface for materials to wipe the opening CLEAN. The same dewatering efficiency is prevalent and we might add that this screen was also designed for operations where slivers of materials passing through are objectionable in the end product. Made in all sizes and shapes wherever applicable to higher and productive efficiency.

Wedge-Wire CORPORATION
Gas Street at Nickle Plate R. R.
Wellington, Ohio

WORLDWIDE PROFESSIONAL DIRECTORY

AGENCE MINIERE & MARITIME S. A.
2 rue Van Bree, Antwerp, Belgium
Sworn weighers, samplers, assayers of ores, metals. Agents for shippers to European ports, plants. Market surveyors, commercial advisers assuring sales

HERBERT BANKS JOHNSON
CONSULTANT
Electrostatic Separation
Process Developments
520 East Ave. Rochester 7, N. Y.

LUNDBERG EXPLORATIONS LIMITED
Consulting Geologists & Geophysicists
Specialty Airborne Electromagnetic
Radioactive & Magnetic Surveys
VICTORY BUILDING, TORONTO

JOHN F. MEISSNER ENGINEERS, INC.
Consulting Engineers
Conveyor Systems — Storage Methods
Crushing Plants — Ship Loading Docks
Materials Handling and Processing Plants
308 W. Washington St. Chicago 6, Ill.

HARRY J. WOLF
Mining and Consulting Engineer
Examinations—Valuations—Management
One Park Place, New York 7, N. Y.
Cable: MINEWOLF Tel.: Hector 2-5307

viding modern equipment for swiftly loading sulphur aboard freighters.

CHILE—The French firm, *Compagnie Miniere du M'Zaita*, operating a copper mine in Chile, is negotiating with the Official Chilean Institution for the reopening or the sale of its Chilean smelter at Chagres which has been inactive for a number of years. The firm is said to be cooperating with another French firm, *Pennaroya*, in mining research in the southern part of Chile which has already provided encougaging results. All of the copper output of M'Zaita is sold to France.

BRITISH GUIANA—*Barima Gold Mining Company (Canada) Ltd.* has acquired a promising bauxite and mica prospect in northern British Guiana close to the coast. The property covers 230,000 acres. Exploration work is underway to determine whether the bauxite operation is commercially feasible. Exploration of the mica deposit is expected to take longer to evaluate. The company still retains gold and other mineral rights to its manganese property; the manganese rights were sold last year to *Northwest Guiana Mining Company*, a subsidiary of *Union Carbide and Carbon Corporation*, for $625,000.

BOLIVIA—United Nations representatives in Bolivia as part of the Technical Assistance Mission have made suggestions concerning the *Banco Minera* which are now being considered by government officials. One proposed change is in the name, the mission has suggested "*Instituto de Rescate y Fomento de la Mineria*," or *Institute of Mineral Trade and Development*, emphasizing its duties concerning mineral development and sale of production which, the mission believes, should be its main job. The group also urged the establishment of a credit supervisor to set up credit standards and to determine technical aid needed by various operators to function more profitably. The U. N. group will submit a formal report to the Bolivian government about their findings and recommendations.

MEXICO—Over 12,429 tons of fluorspar ore from mines in Northern Mexico crossed the United States border at Boquillas and Stillwell's Crossing for trucking to Marathon, Texas in 1954. In January 1955 shipments totaled 1,630 tons and in February figures exceeded 2,000 tons. The fluorspar comes from small mines in the state of Coahuila. The ore occurs in small deposits and is run through a jig to upgrade it before being trucked to Marathon for rail shipment. Importers at the present time are Bishop Bailey of El Paso, Texas, W. H. Crider of Alpine, Texas, and Alberto Ramos of Piedras Negras, Mexico.

COLOMBIA—For the nine-month period ended February 28, 1955, *Bulolo Gold Dredging Ltd.* dredged 11,454,150 cubic yards to recover 45,628 fine ounces of gold. In the same period of 1954, 10,874,180 cubic yards had been dredged to recover 55,757 fine ounces.

CUBA—The five major chrome mines, located in Oriente Province, yielded a total of 5,498 tons of ore last January, according to the chief of the Bureau of Mines of the Ministry of Agriculture, Antonio Calvache. He reported that during that month Cuba exported 7,669 tons of chrome. Biggest producer was the *Cayo Guan* mine in Punta Gorda with an output of 3,500 tons. Of the total exported, 5,530 tons went to Trieste and the remainder to Newport News, Virginia.

CHILE—Discovery of a high-grade sulphur deposit is reported in the Julia Segunda and Casualidad areas near the Bolivian and Argentine borders. The Chilean Department of Mines and Fuels has become increasingly interested in developing the country's vast sulphur reserves, and is studying modern mining and refining methods. It is reported that government funds are being loaned to one of the national development agencies, *Compania Azufrera Purico*, to install a large-scale modern refining plant.

PERU—The *Vanadium Corporation of America's* Peruvian vanadium properties at *Mina Ragra* produced only 195 short tons in 1954 as compared with 348 short tons in the previous year. Reason given for the decrease was concentration on development work during the year. The mines are located at 15,600 feet above sea level in the Andes Mountains of the Chaupimarca district, province of Junin. The ore is transported six miles by narrow gauge railway to Jumasha where a concentration and leaching plant is in operation.

MEXICO—Work resumed in *La Dolores* silver mine, in March after being closed almost two years. The mine had been a unit of the *American Smelting and Refining Company* until an explosion and fire in April 1953. The mine is now being operated by the *Impulsora Minera de Angangueo*, composed of miners, businessmen, and the Chamber of Commerce of the town of Angangueo. Reportedly there is a lead deposit that has never been worked, and the new group intends to develop it.

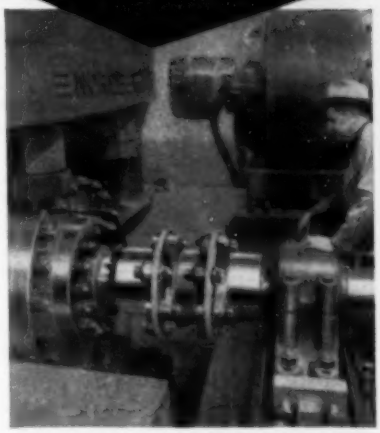
BRAZIL—During the first ten months of 1954, the state of Rio Grande do Sul produced 7,136 tons of copper ore, with a monthly average of 714 tons. To this should be added 832 tons of concentrate also obtained in the state. Copper ore reportedly is also found in Bahia and areas of the northwest region where the Paulo Affonso hydroelectric plant is located.

MEXICO—*Cia. Fundidora de Fierro y Acero de Monterrey* S.A. will complete a $7,200,000 expansion and improvement program this year that will enable it to fill annual orders for 250,000 metric tons of steel and steel products. The increased production is expected to save Mexico about $8,000,000 annually by not having to import about 120,000 tons in steel and steel products.

BRAZIL—Rich deposits of lead ore have been located at Alto Garcia, district of Blumenau, state of Santa Catarina. The deposits are said to contain at least 1,000,000 tons of argentiferous-lead ores. *Cia. Sul-Brasileira de Mineracao* has already started mining operations. Until recently the only galena deposits of interest in Brazil were found in the Rio Ribeira Valley, States of Sao Paulo and Parana. At present Brazilian production is about 3,000 tons of lead annually, while consumption is about 25,000 tons annually.

MEXICO—The National Technological Institute announces that the Mascota district near the Pacific coast of Jalisco definitely has small deposits of radioactive ore. This was the verdict after assaying ore samples from the area. The Mexican government, through the Ministry of National Economy, is paying a $2,000 cash reward for all proven deposits of uranium and other radioactive ores.

Specify THOMAS ALL METAL FLEXIBLE COUPLINGS for Power Transmission to avoid Costly Shut-Downs

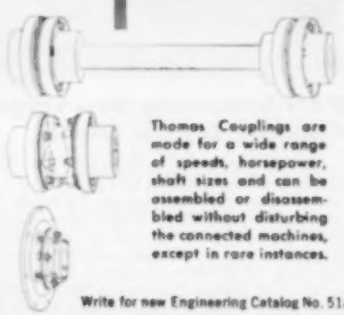


For regular industrial applications as well as those extra tough jobs in heavy industry.

Patented Flexible Disc Rings of special steel transmit the power and provide for parallel and angular misalignment as well as free end float.

DISTINCTIVE ADVANTAGES

FACTS	EXPLANATION
NO MAINTENANCE	Requires No Attention. Visual Inspection While Operating.
NO LUBRICATION	No Wearing Parts. Freedom from Shut downs.
NO BACKLASH	No Loose Parts. All Parts Solidly Bolted.
CAN NOT "CREATE" THRUST	Free End Float under Load and Misalignment. No Rubbing Action to cause Axial Movement.
PERMANENT TORSIONAL CHARACTERISTICS	Drives Like a Solid Coupling. Elastic Constant Does Not Change. Original Balance is Maintained.



Thomas Couplings are made for a wide range of speeds, horsepower, shaft sizes and can be assembled or disassembled without disturbing the connected machines, except in rare instances.

Write for new Engineering Catalog No. 51A

THOMAS FLEXIBLE COUPLING CO.
WARREN, PENNSYLVANIA, U.S.A.

PRODUCTION EQUIPMENT PREVIEW

PEP is just what new equipment, increased mechanization, and new methods can give to your mine, mill or smelter. This PEP section is MINING WORLD's way of making available to you some of the finest current information on mechanization.

Syntron Co. Double Decked Balanced Vibrating Screen

The first in a series of dual deck balanced vibrating screens manufactured by Syntron Company, has recently been completed at their plant in Homer City, Pennsylvania. With the dual decks operating in reverse motions, guide links permit them to follow the eccentric drive movements counter-balancing each other. The normal reaction-absorption of large single deck screens is utilized by the bottom deck to provide a more active screening area. The screens operate at the relatively low frequency rate of 1,000 vibrations per minute and the high amplitude stroke of $\frac{5}{16}$-inch and are said to provide efficient de-watering, scalping, de-dusting of coarse and medium sized ore. The model 2-B dual deck balanced vibrating screens are available for either suspension or floor mounting and can be installed horizontally or declined. They can be provided in any specified length. Circle No. 75.

P&H Announces New Large Capacity Electric Shovel

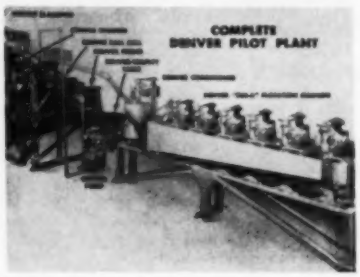
Details have been released by the Harnischfeger Corporation on its newest and largest electric shovel. Designated the P&H model 1800 it has an 8-cubic yard capacity and is said to introduce many new features in large shovel design. The first P&H 1800, equipped with a 9-cubic yard dipper, has joined forces with four other P&H shovels at the Bagdad Copper Corporation, Bagdad, Arizona. Some of the most outstanding features of the model 1800 include; P&H electronic control for all operating functions, centralized a.c. motor drive, widespread boom foot with rubber shock absorbers, and externally mounted propel brake. To learn of the many other important features of the P&H 1800 circle No. 70.

Dorr-Oliver Announces the Oliver Type L Pump

Dorr-Oliver, Inc. announces the availability of a new, six-page, two-color bulletin, "The Oliver Type L Centrifugal Pump." It describes the mechanical features, types and sizes, materials of construction, applications, and advantages of this corrosion resistant chemical pump. Included are drawings and photographs of the unit and its component parts, as well as performance curves for the four available models. Major design improvement of the type L pump is the high cut-water or tongue of the volute—a feature which makes the unit self-venting, minimizes formation of air pockets, and improves priming characteristcs. Also, location of the verticle center line of the outlet in the same vertical plane as the inlet simplifies piping arrangements. Circle No. 77 for your copy.

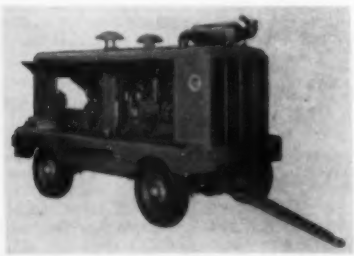
New Geiger Counter Announced by Nuclear

A new Geiger counter, the Model 2613 "Oracle", has been developed by the Nuclear Instrument and Chemical Corporation. Nuclear, long a leader in the manufacture of precision radiation measuring instruments designed the "Oracle" in answer to the prospector's demand for a sensitive and trouble-free Geiger counter. Extra sensitivity is provided by a cluster of ten specially treated, long-lived Geiger tubes. An additional feature of the ten tubes is that if one or more tubes should fail, the instrument can be recalibrated in the field to continue operating. For complete information on the new "Oracle" circle No. 60.



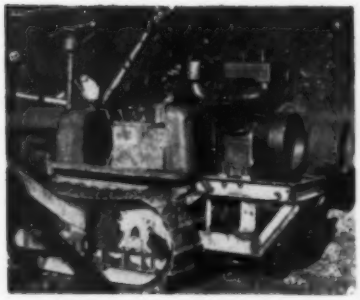
New Denver Equipment Pilot Plant Available

A complete pilot plant has been introduced by Denver Equipment Company. The plant consists of a crusher, ball mill, classifier, pumps, conditioner, flotation machine, and table. The entire unit is supplied with a structural steel base; all pieces are match-marked for assembly at destination. Flexibility is provided to include at a later time other elements of crushing or concentrating equipment as may be required. A bulletin describing typical continuous test plant layout is available together with additional information on Denver pilot plant equipment. Circle No. 67.



G-D Announces New Water Cooled Rotary Compressor

An all-new rotary portable air compressor which is said to combine the basic rotary advantages of compactness, light weight and simplicity with the weather-defying advantages of water cooling has been announced by the Gardner-Denver Company. This compressor, named the G-D Rotary 600, has a capacity of 600 cubic feet per minute. The water-circulating system is fully automatic and constantly maintains the most efficient operating temperature for both the engine and the compressor. Also, the new Rotary 600 is equipped with a simple, automatic speed control, the G-D Thriftmeter, which is reported to save fuel and wear and tear on the engine and compressor, because it keeps operating speed of the unit in line with air demands. For more information circle No. 63.

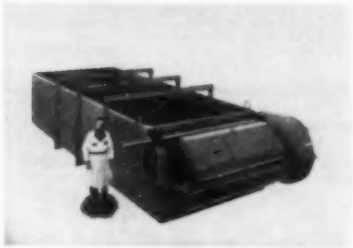


Mobile Mount for Atlas-Copco TC-4 Air Compressor

To facilitate open-pit mercury mining near Cloverdale, California, Buckman Mines adopted this unusual mobile mount for its new Atlas-Copco CT-4 compressor. Two, 2¾-inch drills and pneumatic booms were mounted on an HD-7 Allis-Chalmers tractor. In addition to maximum mobility for the compressor, the tractor's full utility has been maintained. A water tank trailer can be quickly attached by draw-bar hitch for wet drilling. Copco Pacific Ltd. rates its air-cooled CT-4 at 185-cubic feet per minute at 100 pounds per square inch and operating at a moderate speed of 970 revolutions per minute. This is one of a broad series of new Atlas-Copco compressors just recently introduced. For full information on the new Atlas-Copco compressor line circle No. 61.

Braun Testing Equipment Now Manufactured by Bico

Since 1888 the Braun line of laboratory testing apparatus has been well known throughout the world as the accepted standard equipment of its kind. In fact, some of this equipment is said to have been in constant use during these 67 years. Recently the entire patent and manufacturing rights were acquired by Bico, Inc., of Burbank, California who is now marketing under the trade name of Bico. Bico supplies the assay laboratory needs in mining for crushers, sample grinders and pulverizers of various models. Bico-Porter sieve shakers, laboratory furnaces, and accessories are also part of the Braun-Bico line. Circle No. 41.

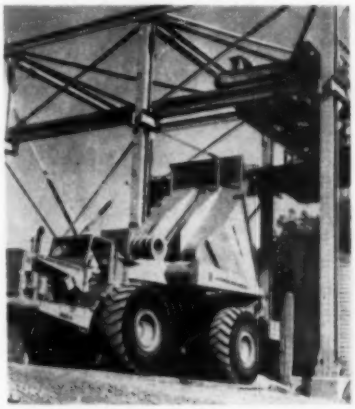


Eagle Iron Works Adds Heavy Duty Log Washer

A new king-size log washer has been introduced by Eagle Iron Works. Diameter of the log is 48 inches. Tub width is 9 feet 4 inches and tub length is 30 feet. While capacity depends largely on size of material to be washed and amount of foreign matter to be removed, the unit is rated at 150 tons per hour. Paddles have replaceable shoes of Ni-Hard, nickel-chromium-iron alloy. This unit can handle material up to 8 inches in diameter. For additional data circle No. 71.

Operational Catalog on Michigan Tractor Shovels

Design, construction, operation and correct application of one-cubic-yard capacity Michigan 75 Tractor Shovels are described and illustrated in a new 12-page catalog offered by Clark Equipment Company's Construction Machinery Division. Models for application on all job conditions are described, including an all-wheel drive, a front-wheel drive and a rear-wheel drive. Optional attachments show the numerous jobs that can be done with a rubber-tired Tractor Shovel. Circle No. 76.



LeTourneau-Westinghouse Announces New Tournapull

LeTourneau-Westinghouse Company has announced a new completely designed machine, the B Tournapull, a 23-cubic yard single-engine, self-propelled scraper. Interchangeable with the scraper for use with the B Tournapull is a 35-ton rear dump. The new machine has been engineered for quick and easy replacement of component assemblies. It is said that all major assemblies, such as transmission, clutch, final drive and differential, can be lifted from the machine without the necessity of time-consuming handling of other components. For additional information circle No. 73.

Ultra-Violet Products To Move to San Gabriel

Ultra-Violet Products, Inc., manufacturers of Mineralight ultra-violet lights for prospecting, display, and industrial use, has purchased the Old San Gabriel Winery as a site for its new $500,000 plant. The firm's headquarters currently are located at Pasadena, California.

The move is expected to be completed by June and has been necessitated by the rapid increase in demand for ultra-violet lights. A feature of the new plant will be a large display of fluorescent minerals, covering more than 1,000 square feet and open to the public.

Notes From The Manufacturers

RICHARD H. KOEHLER has been appointed director of advertising and publicity for Westinghouse Air Brake Company. He moves up from the post of advertising and sales promotion manager at the company's Le Roi Division in Milwaukee, Wisconsin. Mr. Koehler will begin his new work with the parent company in April, headquartering in Pittsburgh, Pennsylvania. He succeeds JOE H. SERKOWICH, who recently resigned.

Steven Ekerovich, whose 14 years of experience in the crushing, calcining and size reduction field has included sales engineering work with Allis-Chalmers and Consolidated Products Company, has joined the Traylor Engineering and Manufacturing Company, Allentown, Pennsylvania. He will work out of the Allentown office as a sales engineer.

John R. Burkett, formerly a business manager for North American Cyanamid Limited, Montreal, Canada, has been appointed assistant to the manager of the explosives department. He has been with Cyanamid since 1935 and has served in the purchasing and dyestuffs sales department.

Pioneer Industries, Inc. opened a new plant and offices at Reno, Nevada in February. The company designs, manufactures, and services radiation detection instruments and advanced electronic equipment.

Herbert D. Imrie, president of Abbot A. Hanks, Inc., has been elected to the executive committee of the American Council of Independent Laboratories, Inc. Mr. Imrie has been president of his firm since 1939. Abbot A. Hanks is one of the oldest independent laboratories in the country, established in 1866.

Dorr-Oliver, Inc. has relocated its Chicago, Illinois office in the Merchandise Mart and opened a new office in the Midland Building, Cleveland, Ohio. Staff members formerly located in Chicago and Evanston will be housed in the new Chicago office. It will serve as headquarters of the Central Sanitary Division managed by *O. V. Lindell* and the Central Industrial Division under the direction of *R. A. Johnson*.

Hewitt-Robins, Inc., has been awarded a contract to supply two miles of conveyor belting and machinery components for the new San Manuel Copper Company mine in Tiger, Arizona. This will be the third largest copper mine in the United States when it goes into operation in 1956.

Cummins Engine Company, Inc. has appointed *M. W. Brooks* as regional manager for the mid-west district, Central Region, with headquarters in St. Louis, Missouri. Until recently Mr. Brooks headed the Industrial Power division of White Motor Company. *H. A. Strohman*, assistant regional manager for Cummins' Eastern Region, has been transferred to the Middle-Atlantic office of the firm at Harrisburg, Pennsylvania.

CATERPILLAR D9 Climaxes 10 Years of Big Tractor Research and Development. Circle No. 40 on the PEP Inquiry Card.

Caterpillar D-9 Tractor—World's Biggest Crawler Makes Its Debut

A 230-drawbar horsepower crawler tractor with turbocharged engine became the sixth machine in Caterpillar's track-type line on May 1. It is the Cat D9 Tractor which already has received considerable attention from mining men during an extensive field testing program in 1954.

Announcement of the D9—the world's biggest, most powerful production crawler—climaxes 10 years of big tractor research and development at Caterpillar. Moreover, the Company has drawn upon 30 years of track-type manufacturing experience to produce a "light-footed giant, with every part aimed at the kind of service which is too tough and too rugged for other tractors."

A new 6¾ by 8, six-cylinder Cat Diesel engine is equipped with a turbocharger, an advancement in track-type tractor manufacture. The tractor also will have Caterpillar's oil-type clutch or, optionally, a torque converter, in-seat starting, hydraulic track adjustment, excellent operator visibility, and many servicing conveniences.

Caterpillar expects the D9 will be used in virtually every track-type tractor application. Some of the available attachments include the No. 9S and No. 9A bulldozers, push cup, front and rear cable controls.

Although the tractor is big, general appearance will conform to the other five models of Cat crawlers. A console-type control panel, seat design, and location and careful arrangement of operating controls make a flat, relatively open deck.

Many features of the D9 were designed with operator comfort in mind. Starting engine controls are readily accessible from the seat. The one-man seat has sponge rubber cushions and is adjustable fore, aft, and vertical. Oil clutch, steering clutches, and brakes are power assisted for ease of operation.

Safety was considered throughout. There are locks on both brake pedals. Pumps are mounted on the rear of the engine to provide constant power for hydraulic actuation of brake and clutch boosters.

Specifications for Caterpillar D9 Tractor

Direct Drive, Series D

HORSEPOWER:

Drawbar	230
Engine horsepower at flywheel	286

OPERATING PERFORMANCE DATA:

Gear	Forward Miles Per Hour	Forward Feet Per Minute	Rated Pull (pounds)	Maximum Pull (pounds)
1	1.6	141	54,200	60,860
2	2.1	185	41,600	46,710
3	2.9	255	30,250	33,970
4	3.9	343	21,000	23,580
5	5.0	440	14,840	16,670
6	6.8	598	9,720	10,920

Reverse (same as forward—6 gears)

ENGINE:

Four stroke cycle, valve-in-head, Diesel	
Number of cylinders	6
Revolutions per minute-governed at full load	1,200
Revolutions per minute—at maximum drawbar pull	800
Lubrication (full flow filtering)	Full pressure
Fuel injection system	Caterpillar-built

FUEL: Burns No. 2 fuel oil (ASTM Specification D396-48T), often called No. 2 furnace or burner oil, with a minimum cetane rating of 35.

STARTING METHOD: In-seat starting with independent two cylinder, four-stroke cycle, gasoline engine.

CLUTCH: Oil type, four metallic-faced plates with over-center engagement. Hydraulically boosted. Clutch lubricated and cooled by oil circulated under pressure.

TRANSMISSION: Unit construction. Selective type speed change. Constant mesh helical gears. Filtered full pressure lubrication for bearings—o.l spray directed on gears.

STEERING:

Clutches	Multiple disc
Clutch friction material	Metallic
Brakes (air cooled)	Contracting band
Clutch release and brake control	Hydraulic booster

TRACK:

Adjustment	Hydraulic
Width of standard track shoe	24 inches
Length of tracks on ground (center drive sprocket to center front idler)	129¾ inches
Area ground contact with 24-inch track shoes	6,228 square inches

CAPACITIES:

	Gallons
Cooling system	35
Fuel tank	157
Lubrication system:	
Crankcase	9
Transmission	15
Flywheel clutch	4½
Final drive (each)	13½
Recoil spring housing (each)	10

GENERAL DIMENSIONS:

Gauge	90 inches
Length (overall)	17 feet 10¾ inches
Height (measured from tip of grouser of standard track shoe to highest point, exclusive of exhaust and precleaner)	8 feet 9 inches
Width (overall)	9 feet 11¼ inches
Height drawbar above ground (measured from lower face of standard track shoe)	21 feet 3/32 inches
Ground clearance (measured from lower face of standard track shoe to lowest point of bevel gear case)	21 feet 7/8 inches

WEIGHT:

Dry weight (approximate)	54,000 pounds
Operating (approximate)	56,200 pounds

Torque Converter Drive, Series D

HORSEPOWER:

Engine horsepower at flywheel	286

OPERATING PERFORMANCE DATA:

Drawbar pull—The torque converter drive will automatically adjust drawbar pull to the load within the following speed ranges.

Gear	Forward	Reverse
1	0-4.1	0-4.1
2	0-5.8	0-7.8
3	0-7.8	—

ENGINE:

Same as Caterpillar D9 tractor, direct drive

CLUTCH AND TORQUE CONVERTER: Dry type, single asbestos-faced plate with overcenter engagement. Three-stage torque converter using engine fuel for hydraulic fluid. Transmission, frame and track construction, lubricating system, and general dimensions are same as on Caterpillar D9 tractor, direct drive.

WEIGHT:

Dry weight (approximate)	54,450 pounds
Operating (approximate)	56,650 pounds

SEPOR MICROSPLITTER a specially designed Jones type riffle used for mixing fine grained materials and obtaining homogenous splits and microsamples is offered by Sepor Microsplitter Supply. The Sepor Microsplitter is being used for reducing moderate size bulk samples to microgram amounts with a high degree of precision. Circle No. 1.

SURVEYING INSTRUMENTS: Wild Heerbrugg Instruments Inc. announces the Swiss precision-designed Wild T-1 optical repeating transit. Both the horizontal and vertical angle are read through a microscope alongside the telescope eyepiece. An optical micrometer eliminates possibility of reading errors. Illumination is provided by a daylight mirror or battery attachment for underground work. For complete data circle No. 2.

RIPPING ATTACHMENT: The Hensley Equipment Company has announced the development of a special ripping attachment to fit your motor grader or bulldozer mold board. The Hensley ripper fits all motor graders and most small dozers with bold boards 18- to 24-inches in height. Ripping depths are 7, 13, and 17 inches. Circle No. 3.

POWER PLANTS: Combustion gas turbine power plants, a newly available source of electrical energy, are now being manufactured by the Westinghouse Electric International Company. This type of power plant has the advantage of requiring very little water, an important factor in isolated arid regions. Also, the weight of such a plant is considerably less than that of a steam-electric unit of the same capacity. It requires relatively little operating and maintenance labor. Circle No. 4.

TIRFOR GRIPHOIST manufactured by Griphoist, Inc. is a manually operated 42-pound-portable hoist. Capacity of the Tirfor is 3,300 pounds at 10 feet a minute with single line, or with multiple sheaves up to 10 tons. Circle No. 10 for full details.

CENTRIFUGAL PUMPS: LaBour Company, Inc. has available a new informative 12-page catalog on their line of packingless self-priming centrifugal pumps. The catalog gives specifications of their different types of pumps, installation instructions, operating information, and a table showing friction of water in pipes. For your copy circle No. 11.

NEW PORTUGUESE PAMPHLET on excavators is available from the Bucyrus-Erie Company. The 16-page pocket-size booklet briefly explains the value of individual design for each model in the B-E line of ⅜- to 4-cubic-yard excavators. Translated into Portuguese the quick, easy-to-read booklet sums up the different excavator's advantages with field photos of each size machine highlighting the illustrations. Circle No. 12.

DIAMOND BIT CATALOG: Diamond Tool Research Co., Inc. of New York has recently issued a four-page catalog covering its complete line of diamond drill bits and reaming shells. A choice of three matrices enables you to select the one best suited to your drilling conditions. Diamond Tool, a prime importer of diamonds, also offers rapid resetting service which is described in the catalog. For your copy of the catalog and a price list circle No. 13.

ORE CARS: The world's largest bottom dump hopper cars with automatic air-operated clam-shell doors, will be constructed by Baldwin-Lima-Hamilton Corporation for the San Manuel Copper Corporation, San Manuel, Arizona. The contract calls for 45 of these mammoth ore cars; each car having a capacity of 70-cubic yards struck or 100 tons, and weighing 68,000 pounds. For complete information on Baldwin-Lima-Hamilton ore cars circle No. 6.

INTERNATIONAL TRUCKS: Thirteen new six-wheel motor truck models have been introduced by the motor truck division of International Harvester Company. This brings to 92 the number of tandem drive units offered by Harvester. To learn more about Harvester's new truck line circle No. 7.

PORTABLE SKYHOOK: The Magic-Pole Unipod, manufactured by the B. E. Wallace Products Co., fills the need for a practical portable skyhook as a hoist support. The Magic-Pole Unipod provides a sturdy support for hoists while lifting, shifting, or lowering equipment, at almost any location, either indoors or out. Circle No. 8.

DUST COLLECTORS: The American Wheelabrator & Equipment Corporation has available several booklets showing various installations of their Dustube collectors in the mining and metallurgical industries, plus sizes and specifications of the different models. For yours, circle No. 9.

CENTRIFUGAL PUMPS: Dorr-Oliver Incorporated has developed three additional sizes of the Oliver type L centrifugal pump. The complete range now includes 1-, 1¼-, and 1½-inch models in addition to the 2-inch unit. These corrosion resistant chemical pumps are said to incorporate new elements of design which increase efficiency and simplify priming. For more details circle No. 30.

FLOTATION MACHINES: How the Denver "Sub-A" Super Rougher has been engineered to handle large volumes of pulp with the greatest possible efficiency is discussed in a bulletin recently published by Denver Equipment Company. Cell dimensions and specifications are also included. Circle No. 24.

DRILLING: In a recent drilling test conducted by the American Percussion Tool Co. it was reported that their rotary percussion drill developed a 3 to 1 drilling ratio over conventional rotary drilling. Cuttings resulting from ordinary rotary drilling averaged 1/16- to ⅛-inch i nsize, while those from the rotary percussion drilling were ⅛-inch to 200 mesh. To find out how the American Percussion drill can increase your hole footage circle No. 31.

V-DRIVE SELECTIONS, using new horsepower rating and improved rating techniques, can now be made quickly and accurately by means of a bulletin prepared by the Fort Worth Steel & Machinery Company. The bulletin also contains engineering information on other types of V-belt drives. For a copy Circle No. 33.

½-YARD SHOVEL-CRANE: Link-Belt Speeder Corporation has introduced a new ½-yard machine with "big rig features." The new machine is the LS-58. It is stated that the purpose of offering this combination of big rig features in a ½-yard machine, is to assure a greater return per equipment dollar. To learn more about how the LS-58 can help you circle No. 39.

HIGH RESOLUTION SEISMIC system was designed by Houston Technical Laboratories to meet demands for an extremely versatile system of exploration for minerals, to obtain detailed information in the depth range of 50 to 5,000 feet. For complete details circle No. 46.

LE ROI COMPRESSOR CATALOG: A new catalog just issued by Le Roi Divi-

Circle numbers and mail this card for free product literature

to get further information on any item described in the Production Equipment Preview, note the key number of that item, circle the corresponding number on the PEP card at the right, and mail. If mailed from a point outside the United States, proper postage must be used.

PLEASE PRINT

This card may also be used to subscribe by filling in here

See other side for subscription rates

MAY 1955 — **NOT GOOD IF MAILED AFTER JULY 25**

FILL IN NUMBERS OF ITEMS YOU DESIRE

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80

Also send further free information on the equipment advertised on pages:

..... ; Product ..... Manufacturer .....

..... ; Product ..... Manufacturer .....

Name ..... **Title** .....

Company .....

Address .....

2—2

Use this section to subscribe only

☐ New Subscription ☐ Renewal ☐ 1 yr. $3 ☐ 2 yr. $5

Name ..... **Title** .....

Company .....

Address .....

sion of Westinghouse Air Brake Company pictures all of the 40 models of portable type compressors available. The quick reference chart shows the capacities, engine types, and mountings. The colorful bulletin also illustrates the many exclusive Airmaster features. Circle No. 47.

NEW BUCYRUS-ERIE 40-R: The Bucyrus-Erie Company has added another model to its line of rotary blast hole drills. It's the 40-R—designed for drilling 6¾ to 9-inch holes. Like the bigger 50-R this new drill features the flexibility of Ward Leonard variable-voltage control that gives the operator smooth instant command over rotation speed of drill pipe at all times. In addition you have your choice of either electric or diesel-electric power, plus several other field-proved advantages. Circle No. 48.

DINGS RM MAGNETS, manufactured by the Dings Magnetic Separator Co., are said to be the most efficient tramp iron magnets on the market. Reportedly they will stop tramp iron on jobs where magnetic pulleys, old style rectangular magnets or circular magnets fail. Circle No. 49.

FLEXIBLE COUPLINGS manufactured by the Thomas Flexible Coupling Co. are designed for those extra tough jobs found in mining. Some of the advantages which they are reported to have are: no maintenance, no lubrication, no backlash, can not create thrust, and permanent torsional characteristics. For more details circle No. 50.

PROSPECTOR'S DIAMOND DRILL: A diamond drill which a prospector can pack on his back has been marketed by the Diamond Drill Contracting Company. Weighing only 35 pounds, the "Super Pioneer" has easily bored through more than 100 feet of granite in field tests. The machine consists of a five-horsepower gasoline motor equipped with transmission, drill chuck, water jacket, and pressure bar. A 48-pound gasoline-powered water pump has been developed by the company for use with the drill. Circle No. 51.

GEIGER COUNTERS: Uranium Engineering Sales Co. has developed a number of attachments for their BABBEL counter which makes it an all-purpose radiation detection instrument. Some of these attachments are: a load probe for the evaluation of radioactive ore in mine stockpiles or storage bins, a lead shield for evaluation of mine faces, and a horizontal probe for evaluation of drill holes. Circle No. 52.

AKINS CLASSIFIERS: Colorado Iron Works Co. has prepared a catalog on their Akins classifier which includes: mechanical and metallurgical operational features, capacity tables, general dimensions, applications on different types of ores, and other valuable information. Circle No. 53 to get your copy.

NEW TYPE ROCK BIT: Herb J. Hawthorne Inc., has developed a new rock bit, the Hawthorne Type "E," available in sizes from AX to NX, which is said to be improving the efficiency of rotary drilling on the Colorado Plateau. Like all Hawthorne bits, these tungsten carbide insert bits were developed on Hawthorne's patented interchangeable, replaceable blade design, permitting the use of many sets of blades with the same bit body. Circle No. 55.

RADIATION INSTRUMENTS: Precision Radiation Instruments, Inc. have developed a new Royal Scintillator for uranium prospecting and exploration. Made by the manufacturers of the famous Scintillator, the Royal claims many outstanding features in radiation detection. To learn more about the new Royal Scintillator circle No. 59.

REPAIRING CONCRETE FLOORS: An outstanding flooring development, STONPACH, is designed for durable patches or complete overlays where acid, grease and oil conditions have pitted and destroyed concrete surfaces. It is said to outlast concrete many times over, and comes complete, ready to use. It needs no sand or cement. Information is available from Stonhard Company Philadelphia, Pennsylvania, or by circling No. 23.

PROTECTION FOR YOUR PROFITS is the title of a new service booklet just released by the Caterpillar Tractor Company. This publication is tailored to help equipment owners acquaint themselves with the latest service equipment, preventive maintenance practices, and methods that may be utilized to speed up emergency field service. Circle No. 36.

COFFING SPUR-GEAR HOISTS: A bulletin describing the company's line of spur-gear hoists is now available from the Coffing Hoist Company. The bulletin includes pictures, cut-away drawings, descriptions and specifications of the entire YC and YCT lines, making a total of 62 different sizes and models with capacities from ¼ to 25 tons. Circle No. 37.

PREVENTS BACKWARD ROTATION: The American Pulley Company announces that its Shaft-King Speed Reduction Unit is now available from stock, equipped with an internal backstop. The internal backstop is a safety device which prevents backward rotation of the unit when driving torque is removed. All sizes of the speed reducer, in both 13 to 1 and 20 to 1 ratios, can be equipped except the two smallest sizes. Circle No. 32.

OPERATORS BOOKLET: Another printing of "How to Operate a Lift Truck" has been completed by Hyster Company, and is now available to lift truck operators, supervisors, safety engineers and other interest industrial personnel. To obtain your copy circle No. 34.

NEW COUNTERS: A complete new line of uranium prospecting instruments has been announced by El-Tronics, Inc. of Philadelphia. Eleven new models are included and prices range from $21.95 for a pocket-size geiger counter up to $999.95 for the Master Scintillation Counter. Circle No. 35.

NEW PIPE CONNECTION: A new connection has been designed which offers the mining industry the first "one specification" connection for all piping applications and pressure ratings. It requires no selection of gaskets, facings or bolts, all parts being fully interchangeable and re-usable. It was developed by the Gray Tool Company of Houston, Texas, and employs a two-bolt clamping principle. For details circle No. 38.

LET YOUR DIESEL LIVE is the title of 15-page booklet published by the Caterpillar Tractor Company. The development of more efficient lubricating oils to get many years of reliable service from diesel engines is reviewed. To obtain a copy circle No. 42.

MATERIALS HANDLING STUDY: A 22-page brochure, titled "Chemicals—Handling and Storage" has been released by Sauerman Bros., Inc. It describes Sauerman Storage Machines in use at a variety of installations, and contains many layout drawings and photos showing bulk handling of raw materials. The brochure is worth the study of anyone with a materials handling problem. Circle No. 44 for your copy.

Postage Will Be Paid by Addressee

No Postage Stamp Necessary If Mailed in the United States

BUSINESS REPLY CARD

FIRST CLASS PERMIT No. 3430, Sec. 34.9, P. L. & R. San Francisco, Calif.

MINING WORLD—WORLD MINING

121 SECOND STREET

SAN FRANCISCO 5,

CALIFORNIA

U. S. A.

For Free Product Literature see other side

SUBSCRIPTION RATES:

(Including the annual Review and Directory)

NORTH, CENTRAL AND SOUTH AMERICA:	one year $3 two years $5
OTHER COUNTRIES:	one year $4 two years $7
SUBSCRIPTIONS IN STERLING one year 28/6 two years 50/	P. J. Sergeant MINING WORLD c/o Barclays Bank, 72/73 Cheapside, London E.C. 2, England
CANADIAN CURRENCY: one year $3 two years $5	MINING WORLD Royal Bank Bldg., Vancouver, British Columbia, Canada

FOREIGN READERS NOTE:

The copy of World Mining you are receiving consists of carefully selected material from the complete American edition of Mining World to which the above subscription rates apply. If you would like to receive the complete Mining World, fill in the lower section of the reverse side of the card at the left. The card must carry proper postage if mailed from a point outside of the United States. You may send payment or be billed later.

See other side for subscription rates

☐ 1 yr. $3
☐ 2 yr. $5

Address .....

Freeport Starts Sulphur Production at Chacahoula

Freeport Sulphur Company has begun production of sulphur at a new mine, the Chacahoula, located near the town of Thibodaux, 50 miles west of New Orleans. Its development is part of a $25,000,000 expansion program involving four new mines with a combined productive capacity of more than 750,000 long tons per year.

Set in the midst of a dense 100,000-acre cypress swamp, the site had to be cleared and drained before construction of facilities and drilling of wells could begin. These facilities include a power plant to supply superheated water, compressed air, and electric power for the Frasch mining process, an office, machine shop, warehouse, relay station, cooling plant, and storage and loading facilities. The plant has a normal capacity of 3,000,000 gallons of superheated water a day for injection into the deposit to melt the sulphur in place.

Other new Freeport mines are Garden Island Bay at the mouth of the Mississippi; Bay Ste. Elaine, a marine operation in the marshlands 40 miles south of Chacahoula; and Nash, a small property in Texas. The company also operates two other mines—Grande Ecaille in Louisiana, and Hoskins Mound in Texas.

St. Joe Lead Completes Third New Missouri Shaft

St. Joseph Lead Company has completed sinking of the No. 25 shaft at Doe Run, Missouri. This is the third of three new shafts sunk during the past year, and like the other two, it is of circular construction, 12 feet 8 inches in diameter, with smooth concrete walls. It bottomed at a little less than 900 feet.

Shaft No. 23, 950 feet deep, is the original hoisting shaft for St. Joseph Lead's mill at Indian Creek. No. 24 connects to it with a 3,200-foot drift. Shaft No. 25, about 40 miles from Indian Creek, is only about two miles from the ore body being mined in the area of Elvins, River Mines, and Flat River. It will be connected to this ore body on the north by a two-mile drift and the Pim shaft.

A four-machine jumbo was used in drilling the shaft round. Direction and depth of holes were easily regulated by arranging a fixed angle between feed and arms in conjunction with an indexing device for fast spacing. The clamshell mucking machine, with spring-loaded brakes, was powered by two air motors mounted at the shaft collar, but operated by remote control from the bottom of the shaft.

Rare Metals Firms Merge As Horizons Titanium

Horizons Zirconium Corporation has been merged into Horizons Titanium Corporation, by approval of the stockholders who will receive eight shares from the surviving company for each share presently held. Both firms have been engaged in research and development work in the field of rare metals.

Majority stockholder is Horizons, Inc. which will turn over to the remaining company its rights to electrolytic processes for tantalum, columbium, chromium, and vanadium metals. Horizons Titanium has a commercially feasible process for production of titanium from the electrolytic technique, while Horizons Zirconium has concentrated on producing zirconium, hafnium, thorium, and uranium by the same process.

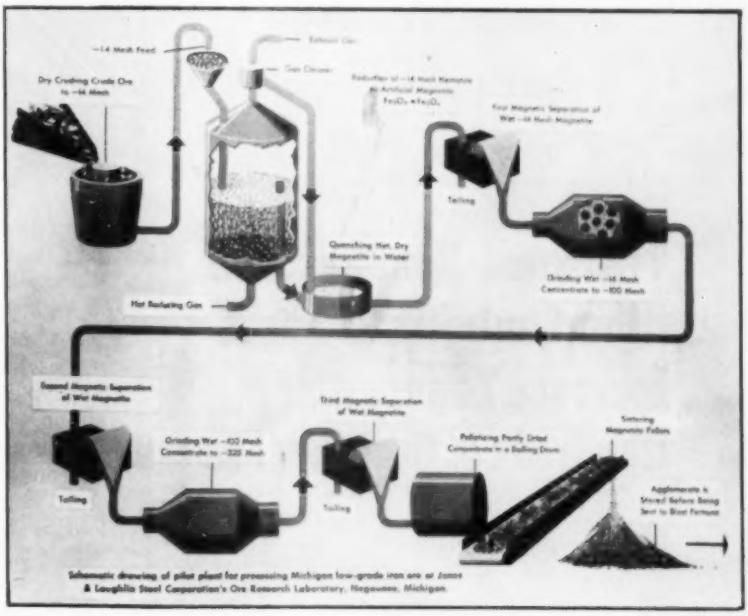
President of the remaining company, Horizons Titanium, is General William N. Porter. Vice presidents are Edwin T. Goodridge, president of Horizons, Inc., and Dr. Eugene Wainer. Secretary is Robert G. McAllen, vice president of Horizons, Inc., and treasurer is Jay D. Cook.

CENTRAL STATES

American Zinc, Lead and Smelting Company has entered into a contract with the *Eagle-Picher Company* which provides for the treatment of approximately 30,000 tons a month of ores mined from the *Rialto* property in the Tri-State district at the Central Mill operation of Eagle-Picher. At Picher, Oklahoma American Zinc's *Nellie B.* operations produced at capacity throughout the year with a total output of 27,002 tons of combined zinc-lead concentrates.

Calumet & Hecla, Inc.'s 7,000,000,000-gallon unwatering of the Osceola Lode at Calumet, Michigan will be completed rapidly now that the 12-inch valve has been opened, allowing for pumping through that pipeline. Over 200,000,000 gallons had to be pumped in order to uncover the valve, after attempts by divers had failed to open it. A 450-horsepower submersible pump is being lowered from the pipeline level to the bottom of the shaft—1,050-inclined feet—to finish this portion of the unwatering. About 1,400 inclined feet in an adjacent shaft remain to be pumped out before the huge unwatering project is finished. (See MINING WORLD, November 1954, pages 38-45; February 1955, pages 71, 72.)

Hicks Dome, 10 miles north of Elizabethtown, Illinois, has been the center of feverish uranium activities lately, with many individuals leasing mineral rights,


Dry Crushing Crude Ore to −14 Mesh
Quenching Hot, Dry Magnetite in Water
Hot Reducing Gas
Tailing
Grinding Wet −14 Mesh Concentrate to −100 Mesh
Second Magnetic Separation of Wet Magnetite
Third Magnetic Separation of Wet Magnetite
Grinding Wet −100 Mesh Concentrate to −325 Mesh
Pelletizing Partly Dried Concentrate in a Balling Drum
Sintering Magnetite Pellets
Agglomerate is Stored Before Being Sent to Blast Furnace

Schematic drawing of pilot plant for processing Michigan low-grade iron ore at Jones & Laughlin Steel Corporation's Ore Research Laboratory, Negaunee, Michigan.

J&L Successfully Makes Michigan Ore Magnetic

The Jones & Laughlin Steel Corporation's Ore Research Laboratory at Negaunee, Michigan has successfully operated what is believed to be the first pilot plant able to render nonmagnetic ores magnetic and concentrate it by magnetic separation. This means that large reserves of nonmagnetic taconite ore, containing about 30 percent iron, could be upgraded to a usable concentrate containing as much as 63 percent iron. Slightly more than two tons of crude taconite are needed to produce one ton of concentrate in this process. Solution of the problem of magnetic conversion is provided by a new type of fluidized solids reactor which is in commercial use, principally for roasting sulfide ores. Operation is on the same principle as the catalytic cracking reactors employed in petroleum refining. Nonmagnetic Michigan taconite, ground to minus-14-mesh particle size, is chemically reduced to magnetite while suspended in a turbulent stream of hot reducing gas. Accurate temperature control and uniformity of reaction is maintained by the intimate contact of gas with the taconite particles in turbulent motion. After leaving the furnace, the hot ore is quenched in water. This shock-cooling produces cracks in the ore which facilitate fine-grinding and better separation of iron mineral from the silica after grinding. Following three successive stages of grinding and magnetic separation, the ore is concentrated to a high-grade fraction containing as much as 63 percent iron. About half of the original ore is eliminated as a high silica waste product.

HD-5G removes mill tailings from a settled tailings pond. Material has been processed for vanadium and will now be processed for uranium. These tailings are wet, heavy and excessively abrasive.

Thousand-Hour Seals on Allis-Chalmers Tractors Increase Tonnage for Hundreds of Uranium Miners

All day long, these tracks grind through a fog of fine, gritty dust as the HD-5G loads uranium ore at the mine. It takes extremely efficient seals to protect bearings in the track assembly under these conditions.

Sometimes it's wallowing in abrasive muck . . . sometimes in fine, penetrating dust. In either case, a tractor works all day in "grinding compound" when it handles uranium ore.

Ability to stand up under conditions like these accounts for the outstanding popularity of the Allis-Chalmers HD-5G Tractor Shovel. Truck wheel, idler and support rollers ride on tapered roller bearings with positive seals that keep dirt out . . . grease in. Seals are so efficient, in fact, that these bearings need lubricating only once every 1,000 hours — just twice a year based on a 40-hour week.

Users find that this feature alone adds up to many tons of extra production a month. Write for literature or ask your Allis-Chalmers dealer to show you how this servicing time saved means work time gained in any mine.

ALLIS-CHALMERS
TRACTOR DIVISION • MILWAUKEE 1, U. S. A.

although a report on the district just released does not classify the area as favorable for commercial uranium. The report is entitled "Explosion Pipe in Test Well on Hicks Dome, Hardin County, Illinois" by John S. Brown, J. A. Emery, and P. A. Meyer, Jr. and appeared on pages 891-902 in the December 1954 issue of Economic Geology, Vol. 29, No. 8.

Filing for incorporation in North Dakota recently were *Tri-State Mining and Exploration Company, Inc.* at Bismarck and *Burmac Exploration Corporation* at Williston. Directors of Tri-State include: Melvin J. Braaten, Lorenzo H. Belk, Clyde Coman, Norman B. Jenson, Harold Irvine, Ivar Nelson, and Merle M. Kenny. Burmac officers are William J. McCabe, president; Doris D. Dallas, secretary-treasurer; and Dr. Donald Towse, consulting geologist, vice president, and exploration manager. Dr. Towse, whose headquarters are at Dickinson, reports that the firm will concentrate on uranium exploration in the Rocky Mountain states and in the Dakotas. Work has started in Harding County, South Dakota, and some aerial surveying is being done on a contract arrangement with *Wahpeton Exploration Company* of Wahpeton, North Dakota.

Uranium Exploration, Inc. has been incorporated under the laws of North Dakota, with offices at Minot. The corporation plans an extensive search for uranium using the latest methods, both airborne and surface. Approximately 21,000 acres are now under the control of the group. Directors are Fay C. DeWitt, H. O. Foss, and Gladys E. Willard, all of Minot. Mr. DeWitt is also general manager.

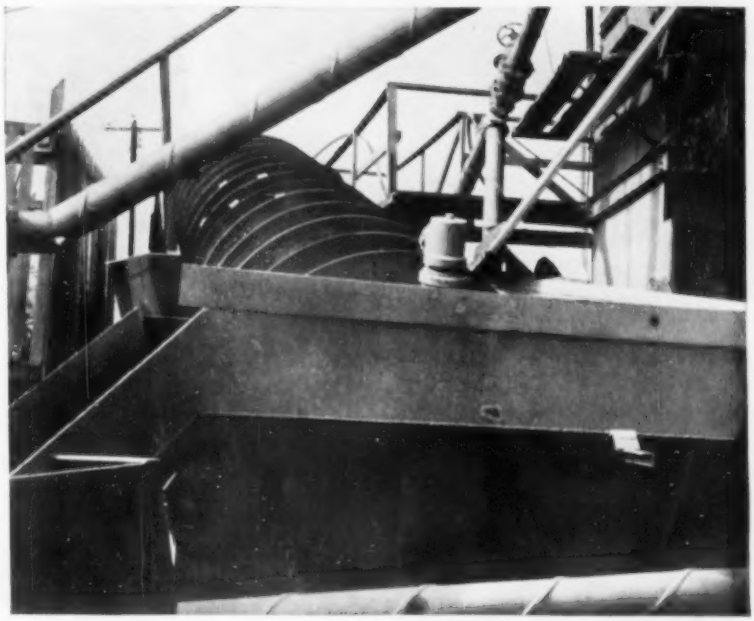
Possibilities of uranium discoveries in Missouri, or the Tri-State District, are something less than remote, notwithstanding several promotions underway, according to Garrett A. Muilenburd, assistant state geologist. He said his office viewed the prospects as nil, citing thorough checks that have been made during the past 10 years and the fact that the geology of the region does not lend itself to the radioactive ores. Water and prospect drill cuttings on file have been checked for radioactivity and several of the larger drill operators have systematically checked the cuttings on every hole without getting any traces.

Appalachian Sulphides, Inc., a subsidiary of *Nipissing Mines Company*, is conducting geochemical and geophysical surveying on property optioned in the Virgilina section of Virginia and North Carolina. Diamond drilling is planned for this summer. The options cover 8,000 acres; an initial payment of $5,500 has been made toward the total purchase price of $43,746. Chalcopyrite, chalcocite, and bornite occur in quartz veins in a severely schisted area. Appalachian is already developing a copper property in Ashe County, North Carolina. (See MINING WORLD, April 1955, page 81.)

American Zinc Company of Tennessee expects mine production to start in July

KING SIZE PERFORMANCE

with NAYLOR *Lightweight Pipe*



It's no trick to get king-size performance from air and water lines in mining service when you use Naylor large diameter lightweight pipe.

Naylor is the one lightweight pipe built to handle jobs normally requiring heavier wall pipe. That's because of Naylor's exclusive lockseamed, spiralwelded structure which creates a pipe that is recognized for its greater strength and safety.

Its light weight makes Naylor pipe easier to handle and install, particularly with the one-piece Naylor Wedge-Lock Coupling to speed connections. Pipe sizes range from 4 to 30 inches in diameter.

For the complete story on this distinctive combination, write for Bulletins No. 507 and No. 513.

NAYLOR PIPE

NAYLOR PIPE COMPANY

1242 East 92nd Street, Chicago 19, Illinois

Eastern U. S. and Foreign Sales Office: 350 Madison Avenue, New York 17, New York

Rebuilding Jaw Crusher Plates

We do NOT recommend this job for the crushing plant maintenance welder, as proper rebuilding requires the use of special jigs and other expensive equipment. Why not call in our field man for a check-up on those used plates in your scrap pile?

with MANGA-TONE N.M. more than doubles life of original plates.

For many years, attempts to build corrugations worn off crusher plates were unsatisfactory. Welding time and materials cost made the practice unprofitable.

With the advent of Two-Tone Welding and our MANGA-TONE N.M. the rebuilding of crusher plates is now an established practice. Experience of plants using our rebuilt crusher plates over a period of 3 or more years, indicates that a plate rebuilt with MANGA-TONE N.M. will give from 30% to 50% greater performance than did the plate when new.

Your RESISTO-LOY distributor, through the Two-Tone Shop, can rebuild your plates for a figure substantially less than the cost of new ones. Photograph shows a stack of rebuilt plates in one of our shops.

RESISTO-LOY CO., INC., Grand Rapids 7, Michigan

An Unfailing Market for:

GOLD • SILVER • COPPER
LEAD • ZINC

Ores • Concentrates • Bullion
Precipitates • Furnace Products

FOR SCHEDULES, FREIGHT RATES, ETC., WRITE TO YOUR NEAREST OFFICE

AMERICAN SMELTING AND REFINING CO.

ASARCO

405 Montgomery Street, San Francisco 4, Calif.
700 Pacific Nat'l. Life Bldg., Salt Lake City, Utah
P. O. Box 1111, El Paso, Texas
Tacoma 1, Wash.
607 First National Bank Bldg., Denver 2, Colorado
810 Valley Bank Building, Tucson, Arizona
East Helena, Montana

at its *South Friends Station* mine in Tennessee. The shaft has been sunk, and installation of headframe and surface plant completed. Shaft sinking has started at the company's *Emert* property in the southeast Jefferson City area where a daily production of 500 tons of ore is expected by 1956. Drilling in the north and east portions of an area near the *Grasselli* mine has indicated a substantial tonnage of good grade ore.

E. I. du Pont de Nemours & Company, Inc. has been granted a certificate of necessity authorizing rapid amortization of 90 percent of $40,000,000 for construction of titanium sponge facilities at Johnsonville, Tennessee.

International Minerals and Chemical Corporation has been spending large sums for installation of a scrubber and other equipment to remove fluorine from gases formed in the processing of phosphate ores at its Florida operations.

Battelle Memorial Institute of Columbus, Ohio has been awarded a $1,000,000 contract by the Defense Department to establish a titanium metallurgical laboratory. The purpose of this lab is to disseminate technical information on titanium to government contractors and their suppliers. The contract is for 18 months to two years and it is expected that the titanium industry itself will eventually finance the work of the lab.

The new mill facilities of *St. Joseph Lead Company* at Balmat, New York operated for a full year in 1954, setting a production record for crude ore concentrates. The combined production of the Edwards and Balmat Division increased to 103,479 tons of concentrates from 99,374 tons in the previous year. The entire zinc output was shipped to the company's smelter at Josephtown, Pennsylvania.

Deposits of good quality uranium ore have been reported in Tennessee. Fred Milan of Elizabethton and Earl Graybeal of Whitesville, West Virginia, have taken mineral right options on 614 acres of land in Carter County and 140 acres in Johnson County after extensive prospecting. Their discoveries are said to have been made in the Heaton's Creek section of Carter County and Hammon's Chapel area of Johnson County.

The Robert Crooks Stanley Fellowships in engineering and science have been established at Stevens Institute of Technology in Hoboken, New Jersey by the family of the late Robert Crooks Stanley, who was chairman of the board of *The International Nickel Company*. The fellowships will be awarded to full-time graduate students working for their master's or doctor's degrees.

It has now been announced that *Nuclear Metals, Inc.* has been functioning as contractor operator of the atomic energy metallurgical research laboratory at Cambridge, Massachusetts since mid-1954. The lab was established during the war and was managed until mid-1954 by the *Massachusetts Institute of Technology*. Its large scientific and technical staff, under the direction of Dr. Albert R. Kaufmann, will continue research in reactor and other materials, including uranium, beryllium, zirconium, and alloys closly associated with the development of atomic energy. Nuclear Metals was organized by *Arthur D. Little, Inc.* of Cambridge, and *Allegheny Ludlum Steel Corporation* of Pittsburgh, Pennsylvania.

The *Schroeder Mining Company* of McGregor, Iowa has announced plans for opening an iron ore strip mine 6½ miles west of Chatfield, Minnesota, about 18 miles southeast of Rochester. Schroeder recently sold properties they were operating in Alabama and Wyoming. Plans are to ship about 15 cars of washed ore a day starting July 1. The grade of ore and type of operation will be similar to that now handled by *M. A. Hanna Company* at Spring Valley, Minnesota.

The *Oliver Iron Mining Division* of the *United States Steel Corporation* has closed its *Godfrey* underground mine near Chisholm, Minnesota, because the mine has become uneconomical to operate under present conditions. The high cost of the ore, of which taxes are a substantial part, together with the decline in the quality of the ore produced made continuance of operations impractical. Six months earlier the Oliver division closed the *Fraser*, east of Chisholm, because it too could not be mined economically. The only remaining underground Oliver mines in Minnesota are the *Pioneer* at Ely and the *Soudan* at Tower.

Geologists from all over the United States and Canada took part in the *University of Minnesota's* institute on Lake Superior geology on April 1 & 2. Chairman of the institute was Carl E. Dutton, regional geologist of the *United States Geological Survey*. Included in a long list of other speakers were: James Balsley, chief of the geo-physical branch of the U. S. Geological Survey, Washington, D.C.; Harold L. James, U. S. Geological Survey, Menlo Park, Calif.; and Stanley Tyler of the *University of Wisconsin*, Madison, Wisconsin. Modern ideas of the stratigraphy and origin of iron formations and ores of the Lake Superior district were discussed at the first day of the institute. Climax of the day was a dinner followed by a panel discussion on geophysics as applied to the district. The second-day program was devoted primarily to short papers on research now in progress.

Ice conditions in Lake Superior indicate a late start in boat movement this year. The railroads indicated that they were ready to start moving ore to the head of the lake April 1, but ice conditions on the lake delayed the start of ore movement until the latter part of April.

The *Erie Mining Company* has adopted a hard hat color code for its taconite operation at Aurora, Minnesota. Designations are as follows: powder men, red; laborers, white; drillers, blue; carpenters, yellow; iron workers, black; electricians, grey; supervision, green; pipe fitters, orange; engineers, green with gold stripe.

If the Uranium's there

YOU CAN'T MISS IT
with an
NCA MULTIPLIER TUBE
A REVOLUTIONARY IMPROVEMENT OVER SCINTILLATION COUNTERS *because . . .*

- Gives highest efficiency at lower gamma energy levels for finding deeply buried deposits.
- Increases geiger counter sensitivity up to 500 times.
- Contains no fragile components like crystals or photomultiplier tubes.
- Is not affected by voltage changes (in a range of 150 to 200 volts) or temperature (−40°C to +100°C).
- Can be attached to any commercial geiger counter.
- Has greater sensitivity — up to 500,000 cmp/mr/hr.
- Has the instantaneous response needed for airplane or auto surveys.
- Provides directional detection, eliminating laborious grid surveys.

Best of all, in combination with the most popular top-quality geiger counter, the NCA ORELOKATOR, Model RM2NA, its cost is far less than that of an equivalent scintillation counter!

Nucleonic Company of America
Dept. MW-5, 196 DeGraw Street, Brooklyn 31, N. Y.
NCA SEND FOR FREE LITERATURE NOW!

BUNKER HILL & SULLIVAN MINING AND CONCENTRATING CO.

Mines and Smelter at Kellogg, Idaho

Buyers of:

Lead ores and concentrates, zinc concentrates, silicious gold ores.

Sellers of:

"BUNKER HILL" brand of refined Pig Lead, Slab Zinc, Cadmium crude Antimonial Lead and Leaded Zinc Oxide.

We are proud of our "BUNKER HILL" trade mark. It represents the highest quality of metals produced. We likewise strive to make "BUNKER HILL" known as a symbol of the highest quality in our relations with our employees, with our suppliers of ores and concentrates, with our stockholders and with the general public.

For information regarding ore rates and shipments Address:

BUNKER HILL SMELTER
Box 29
Kellogg, Idaho

AMERICAN ZINC, LEAD AND SMELTING COMPANY

Buyers of Zinc Concentrates Suitable for Smelting in Retort and Electrolytic Smelting Plants, also Buyers of High Grade Lead Concentrates.

Address Communications to Ore Buying Department

Paul Brown Building
ST. LOUIS, MISSOURI

423 Mills Bldg.
EL PASO, TEXAS

927 Old National
Bank Building
SPOKANE, WASHINGTON

P.O. BOX 577
DUMAS, TEXAS

International Smelting and Refining Co.

ANACONDA
from mine to consumer

Buyers of

Copper, Silver & Gold
Ores and Concentrates:

Copper Smelter—Miami, Arizona
Address: Ore Purchasing Department
International Smelting and Refining Co.
P. O. Box 1265
Miami, Arizona

Lead & Zinc Ores
and Concentrates

Lead and Lead-Zinc Smelter
Lead-Zinc Concentrator
} Tooele, Utah

Address: Ore Purchasing Department

International Smelting and Refining Co.
818 Kearns Building
Salt Lake City, Utah

Please establish contact prior to shipment.

MAGMA COPPER COMPANY

Buyers of

COPPER, GOLD

AND SILVER ORES

MINES AND SMELTER AT

SUPERIOR, ARIZONA

Rare Metals To Install Gould Rotary Furnace

Rare Metals Corporation of America is reopening the Nutmeg mercury mine east of Weiser, Washington County, Idaho. (See MINING WORLD, April 1954, page 77.) Mining will be by open pitting with the ore crushed to minus-3-inches.

A new Gould rotary furnace has been ordered and should be in operation in the summer. This furnace was designed and built by Gordon I. Gould & Co. of San Francisco, California. It is 5½ feet in diameter and 90 feet long. It will rotate 0.75 to 1.0 revolution per minute and will be fired by either bunker oil or propane gas. Feed to the furnace will be by a standard Gould shaker type feeder. An automatic shoot hoeing machine will be used.

Rare Metals is a subsidiary of the El Paso Natural Gas Company and is actively searching for and mining uranium on the Colorado Plateau. Rare Metals recently purchased the Arrowhead Uranium Company's uranium holdings on the Navajo Indian Reservation near Cameron, Arizona and is studying the possibility of erecting a mill.

Hanna's Oregon Project On Two-Furnace Basis

Hanna Nickel Smelting Company's operations at Riddle, Oregon are now on a two-furnace basis, and the company expects to produce between 4,000,000 and 5,000,000 pounds of nickel this year. Last year, while the new process was being perfected, some 300,000 pounds of nickel were produced by this M. A. Hanna Company subsidiary.

More Uranium Discoveries In Idaho and Washington

New uranium discoveries are being reported with increasing frequency in eastern Washington and Idaho. Most recent uranium rush was in the Blue Mountains of southeastern Washington. It was touched off when a prospector brought a "hot" sample of torbernite into Walla Walla for testing. Several hundred persons joined in the search, on foot, by jeep, by plane and by helicopter. Dealers in radiation detectors did a thriving business in towns of the area.

A short time previously, Spokane County recorded its first uranium strike. The ore, found near Mount Spokane, occurs in a pegmatitic phase of granite. An AEC official said the ore was of a massive crystal autunite type resembling specimens from Australia. Limited exposures showed high-grade in tiny veinlets. A rush of leases in the area resulted. A considerable amount of acreage in the area is state park land which at last report had not yet been opened for prospecting and mining.

Many mining claims were filed recently in Stevens County, north of the Spokane Indian reservation, home of Washington's only uranium shipper. The autunite ore there occurs in a granite intrusive contact in sedimentary argillite. Shipments started in December. Most of the claims were staked on the basis of radioactivity indications through snow and virtually no prospecting has been done.

Uranium prospecting activity in Idaho currently is centering in the Elk City and Salmon River areas. Autunite in mica schist has been found about 20 miles southwest of the old gold mining town of Elk City. Newest strike reported from Lemhi County was on Williams Creek. Report of a uranium find near Post Falls, Idaho, east of Spokane, could not be confirmed by an investigating AEC geologist.

The 3400-foot level of the *Silver Summit* mine in Shoshone County's Coeur d'Alene district has been extended into the adjoining Purim area. At last report, about 100 feet of silver-copper ore had been opened along a shoot mined on the 3200 level above. Development work is on a three-shift basis. Interests in the area are owned by *Polaris Mining Company*, which owns the Silver Summit mine and is doing the work, *Silver Dollar Mining Company*, *Hayden Hill Consolidated Mining Company*, and *Lincoln Mining Company*.

Polaris Mining Company's proposed two-mile, below-sea-level exploration tunnel from the *Silver Summit* mine easterly through several adjacent properties is half completed. At last report, the face was within 600 feet of cutting under a crosscut driven at a higher level by *Coeur d'Alene Mines Corporation* several years ago. Work is in the *American Silver-Silver Standard* area. The long tunnel will continue into the *Rainbow* property.

Lead-silver ore has been encountered 200 feet sooner than expected in a southerly drift *Whitedelf Mining and Development Company* is driving on the new 800 level of its mine near Clark Fork, Bonner County, Idaho. The tunnel is being driven under the South ore body mined on higher levels. At last report, some of the ore was being trucked directly to the Bunker Hill smelter at Kellogg. Compton I. White Jr. is president and former Idaho Congressman Compton I. White, secretary-treasurer.

Sidney Mining Company has signed an operating agreement with *Highland-Surprise Consolidated Mining Company* similar to one recently concluded with *Nevada-Stewart Mining Company*. (See MINING WORLD, April 1955, page 77.) The agreement provides that after Sidney has deepened its main shaft to the 2,300-foot level and run an exploratory tunnel through Nevada-Stewart ground, the tunnel will continue on into Highland-Surprise ground. Sidney also has agreed to purchase $10,000 worth of equipment from the H-S mine. The properties are in the Pine Creek zinc-lead district of the Coeur d'Alene mining region, Idaho. Malcolm C. Brown, of Kellogg, is president of Sidney.

Lucky Friday Silver-Lead Mines Company expects to complete its three-compartment shaft-raise east of Mullan, Shoshone County, Idaho about July 1. Current production is about 100 to 110 tons daily from the 1600-, 1800-, and 2000-foot levels. Millheads have been running about 13 ounces of silver, 6.5 percent lead and 1.5 percent zinc. John Sekulic is president and Dave Elder, superintendent.

At the *Star* mine north of Wallace, Shoshone County, Idaho, pumping facilities have been revised and enlarged to handle water from adjoining workings of the *Morning* mine, closed late in 1953. Two 750-horsepower units have been

Simplot Resumes Production at Gay Mine

Production has been resumed at the Gay phosphate mine of J. R. Simplot Company near Fort Hall, Idaho, after the winter season. Before suspension of activities last fall, approximately 607,000 tons of phosphatic shale and high-grade ore had been mined in 1954. Some stripping (see above) for this new season was also done before the weather forced complete curtailment of operations last year. The low-grade shale goes to Westvaco Chemical Company's plant at Pocatello for manufacture of elemental phosphorus by electric furnacing. The high-grade phosphatic beds are mined separately and shipped to Simplot's Pocatello fertilizer plant which has been expanded to add a triple superphosphate unit. A new production capacity in excess of 100,000 tons of high analysis fertilizer is now expected annually.

installed at a new main pumping station on the 4,000-foot level. They will be used alternately. On the 5300 level, a new operating level is being driven which will connect with the old *Morning* workings. Three hundred gallons of water a minute are draining through a diamond drill hole run from the 6300 Star level to the 4650 Morning level. Production is about 20,000 tons of zinc-lead ore monthly. *Sullivan Mining Company* owns the mine, and it is operated by *Hecla Mining Company*.

Iron Mountain Mining Company's property on Adams Creek, Iron Mountain district of Washington County, Idaho, is being examined by *Rare Metals Corporation of America*, subsidiary of *El Paso Gas Company*. Rare Metals has been investigating the *Almaden* cinnabar property 16 miles northeast of Weiser (See MINING WORLD, April 1955, page 77). Frank Mortimer of Weiser is president and general manager of Iron Mountain Mining; Claudia J. Merritt is secretary.

The Silver Syndicate fault-vein is being explored by drifting on the 3700 level of the *Sunshine* mine of *Sunshine Mining Company*, the nation's leading silver producer. The work is in an area midway between current producing areas of the vein. Sunshine has an operating agreement with *Silver Syndicate, Inc.* The properties are in the Coeur d'Alene mining region of Shoshone County, Idaho.

Clearwater Dredging Company plans to resume operations on Crooked River near Elk City, Idaho, in the spring when weather conditions permit. Cold weather halted work after the dredge had worked it way up the old *Gnome* property, four miles below Orogrande.

MONTANA

Pioneer Corporation of Kellogg, Idaho, is planning bulldozer trenching and exploratory tunneling at a 160-acre manganese property near the Bonita rail siding in Missoula County, Montana. Pioneer leased the ground from *Anaconda Copper Mining Company* last summer and subsequently shipped 20 tons of ore from surface outcrops. The sample shipments netted about $500 in manganese settlements and showed presence of silver-copper values. J. J. Jutzy, Spokane geologist, is president, and Bruce E. Allgaier, secretary.

Anaconda Copper Mining Company has entered into an agreement with the General Services Administration for the sale and delivery of nodulized manganese ore. The agreement covers the period ending June 30, 1955 and comprises about 44,000 tons from the *Emma* mine of *Butte Copper & Zinc Company*, operated by Anaconda under an operating agreement.

Rela Welborn and James Selway of Armstead, Montana are reported to have sold 34 undeveloped thorium claims to C. N. George of Laguna Beach, California and associates. The claims are located in the Trail Creek district on the Continental Divide. According to Mr. Welborn, the purchasers plan an initial program of drifting and bulldozing.

F. E. Huff, John Buttleman, and Al Winterood reportedly have discovered uranium in the old *Sweepstakes* mine area north of Harlowton, Montana. They have been mining silver and lead there for about a year. The uranium is said to be found in sandy limestone out crops.

Springtime Mining Company is stripping a small area on its 15,000 leased acres nine miles west of Columbus, Montana, near the old townsite of Springtime. Final assays are awaited.

Mineral King Mining Company is planning early development of two lead-silver ore bodies discovered last summer in surface exploration of its property near Saltese, Mineral County, Montana. Plans call for strip-mining the upper exposure and tunneling into the shoot exposed 1600 feet downhill. Values are in lead and silver. Charles F. Buls, of Missolula, is president.

The *United States Geological Survey*, in the course of geologic mapping for the *United States Atomic Energy Commission*, discovered a deposit of dumortierite seven miles north of Basin, Jefferson County, Montana. This is a comparatively rare hydrous aluminum borosilicate mineral used in the manufacture of spark plugs and other refractory products. It is the second such discovery in Montana and one of the few known deposits in the United States.

AERIAL AND GROUND EXPLORATION FOR URANIUM AND OIL

with the finest
Scintillation Detector System *ever built!*

Radioactive anomalies caused by uranium or oil deposits are accurately detected and instantly recorded in the air or on the ground with the *NEW* DS-7 survey system.

Extremely High Sensitivity—3 inch sodium iodide crystal; 3 inch phototube; greater than 1 million cpm in a 1 mr field.

Rugged Construction—all units thermal insulated and shock mounted; Phototube and Crystal *triple* shock mounted.

Completely Moisture Proof—circuits operate indefinitely at 100% humidity.

Maximum Flexibility—separate units easily adaptable to various installations.

Low Power Consumption—*only* 65 watts.

Light Weight—approximately 75 lbs. total weight.

The Nuclear-Chicago Scintillation Detector System is ideal for airborne or ground vehicle application. Write for full technical details with typical installation suggestions and exploration techniques, Bulletin "DS-7 Explorations."

nuclear-chicago
Nuclear Instrument and Chemical Corporation
2338 West Erie Street, Chicago 10, Illinois

From tail cable connection to dipper teeth

Mr. and Mrs. Wayne Wetzel, while prospecting for silver and lead on a ranch nine miles from Drummond, Montana, discovered a cobalt deposit. Nothing can be done about development until the snows clear.

OREGON

A new massive chromite ore body has been opened on Red Mountain, 12 miles southwest of Ashland, Jackson County, Oregon, by the McTimmonds Brothers of Grants Pass. An unusual feature of the ore is that fractures are coated with malachite. A recent shipment contained 55 percent chromic oxide and returned $165.00 a ton at the Grants Pass buying station.

Mining and milling capacities at the *Haggard* and *New* chromite mine near John Day, in eastern Oregon, will be increased under plans of the new operators, J. J. Kinsella of Velview, Idaho, and C. G. Cafarelli of Salt Lake City. They have purchased the interest of Burt Hayes, who has been shipping ore since reopening the old property in 1953.

A placer gold operation is planned on Galice and North Fork Creeks, Josephine County, Oregon by Wesley Pieren and Antone J. Nielsen of *Evergreen Mining Company*. A bulldozer is used to remove overburden.

The *Wonder, Daily Dozen, Roy Jackson, Bowser, Graham,* and *White* chrome properties on Chetco Divide, Curry County, Oregon, have been leased by J. R. Holman, Walter B. Freeman, and LaVern Twombley to *Tulare Bros. Mining Company* of Gold Hill. Holman and associates have an 80-ton mill on the Wonder property, which they developed in 1954.

WASHINGTON

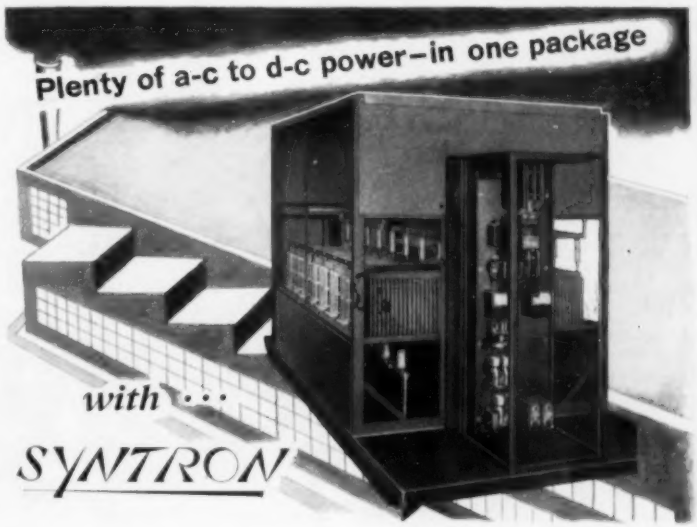
A new stopper, slusher, air trammer, electric hoist and pump have been installed by *Kromona Mines Corporation* in Snohomish County, Washington's Sultan district. Another Wilfley concentrating table has been installed in the mill circuit for clean up of tungsten concentrates. A conveyor housing from mill to tailing dump was rebuilt. An impounding basin was started below the mill. The management is considering acquisition of larger ore cars to cut tramming costs. Sufficient copper-silver-gold-tungsten ore was blocked out during 1954 to keep the mill operating for six months at 100 tons daily. Development ore netted more than $13,000. Joe F. Krom of Seattle is president.

Wellpinit Uranium Associates has been formed to prospect for uranium in Stevens County, Washington. It has filed on several mining locations. A. C. Townsend of Spokane is trustee.

Howe Sound Company's 4,000-foot exploration drift being driven from its *Holden* mine workings in Chelan County, Washington, has reached more stable ground after being slowed by bad rock conditions. At last report, the drift had been advanced about 1,300 feet.

Evergreen Uranium, Inc. has been organized by six Spokane, Washington men to develop a promising showing of high-grade autunite in Spokane County only 20 miles northeast of Spokane. Occurring in veinlets in cracks in pegmatitic granite, the ore was found by Alfred and Leonard Dahl on their father's farm near the base of Mount Spokane. They were prospecting in Montana when one of them remembered finding some greenish crystals while digging a posthole on the farm about 12 years ago. Stripping of top soil revealed the ore. They leased the mineral rights to Kae Sowers, James W. Fox, Thomas Smith, Armour Smith, Ken Coppock, and John F. Campbell, who organized the mining firm. Early drilling is planned, along with prospecting operations on nearly 4,000 additional acres acquired in the area.

First 600 tons of ore shipped from the property of *Midnite Mines, Inc.* on the Spokane Indian reservation in southwestern Stevens County, Washington averaged 0.285 percent uranium oxide. Grade of the ore continues to improve as depth is obtained in the open-pit mining operation. Mining was suspended in February because of weather conditions and road restrictions subsequently held up shipments. The ore has been proven to be of an easy milling type. Clair Wynecoop is company president.



POWER CONVERSION UNITS

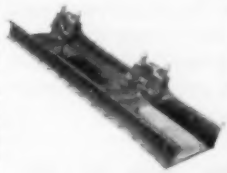
Heavy Capacity • Complete • Ready For Operation

Provide 125 volt to 550 volt a-c to d-c current for Mining Machinery—Haulage Locomotives—Elevators—Cranes—Hoists—Machine Tool Motors—Printing Press Motors—Synchronous Motor Excitation—Magnetic Chucks—High Intensity Arc Lights—and general a-c to d-c Power Service.
Require only a fraction of the floor space necessary for turbine type power installations. Have no moving parts to be serviced. Automatic voltage regulation. Require no warm-up period.

. . . and For Increased Mining Profits

ELECTRIC VIBRATORS
For a free flow of stubborn materials through bins, hoppers and chutes.

VIBRATING SCREENS
Heavy tonnage sizing and scalping. Replaceable screen surface, electromagnetic finger-tip control.

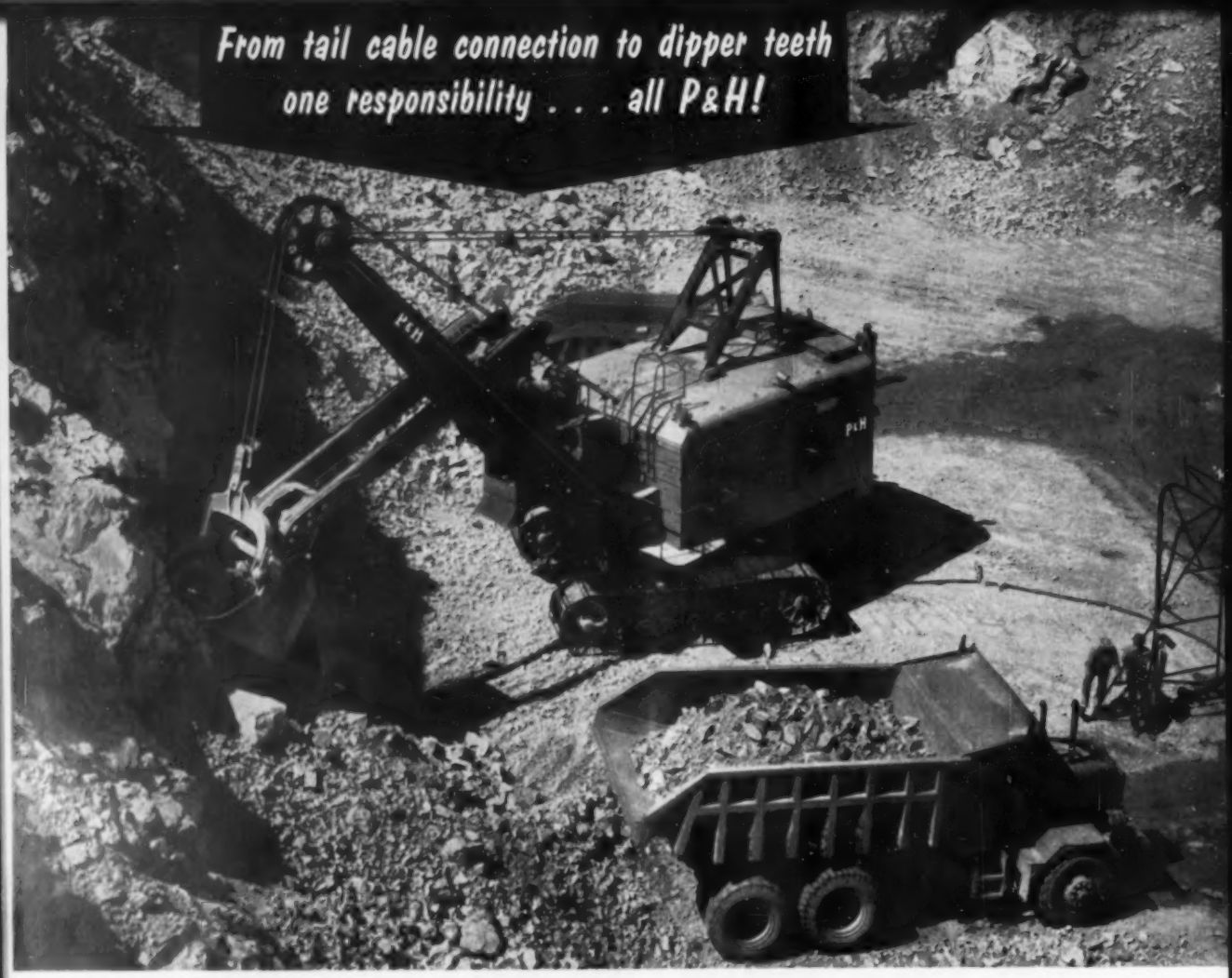


TEST SIEVE SHAKERS
Insure high speed, accurate sizing of test samples. Positive control of time and speed for uniformity.

SHAFT SEALS
Self-lubricating, mechanical seals for rotating shafts of pumps, compressors, etc. Will not cut or score shaft.

Send for complete catalogue data — FREE

SYNTRON COMPANY
166 Lexington Ave. Homer City, Penna.



How P&H ELECTRIC SHOVELS cut tonnage costs with these two great features:

ELECTRONIC CONTROL — provides marked advantages over any other type of control available on electric shovels today. It's far easier, of course, and completely effortless. *Fatigue factor at end of shift is hardly discernible.* Response is faster. It is applied to all operating functions and arranged so the operator has co-ordination to get the utmost out of his shovel. Comparative tests indicate cycles 10% faster.

MAGNETORQUE* HOIST DRIVE — the electro-magnetic power transmission that provides faster dipper speeds at heavier bail pull. Higher torque is automatically produced at low speeds and vice versa. It enables you to come through the toughest banks with the smooth surge of power where other dippers falter or stall. It means extra production. Inherent slip characteristics cushion machine from impact stresses. Magnetorque is friction-free, worry-free; proved in over 1000 installations.

These two P&H exclusive features team up with many other advancements to give you still lower production costs in all kinds of open pit work. We have facts that speak volumes. You should have them. Write us. Ask to see the movie "Magnetorque Hoist Drive." P&H Electric Shovel Division, Harnischfeger Corporation, Milwaukee 46, Wisconsin.

*T.M. of Harnischfeger Corporation for electro-magnetic type coupling.

HARNISCHFEGER

the P&H Line

Mines Development to Run Edgemont Uranium Mill

The United States Atomic Energy Commission is negotiating a contract with Mines Development, Inc., Denver, Colorado, covering the construction and operation of a plant to process uranium ores in the Black Hills area of South Dakota.

Mines Development, Inc. will finance the construction and operation of the plant at Edgemont, South Dakota, and uranium concentrates will be sold to the AEC. President of Mines Development is George Bator, former Colorado School of Mines faculty member, and vice president is Allen D. Gray.

This plant will be the tenth uranium mill now operating in the United States. The other nine are United States Vanadium Company's plant at Uravan and Rifle, Colorado; Vanadium Corporation of America's plants at Naturita and Durango, Colorado; Anaconda Copper Company's Bluewater, New Mexico mill; Vitro Corporation of America's plant at Salt Lake City, Utah; Climax Uranium Company's mill in Grand Junction, Colorado; Kerr McGee Oil Industries, Inc.'s mill at Shiprock, New Mexico; and the AEC-owned mill at Monticello, Utah. Vanadium Corporation of America also operated a mill at Hite, Utah, but this was closed down.

UOPA Exposition Slated For Grand Junction May 6-8

Annual exposition of the Uranium Ore Producers Association will be held May 6, 7, and 8 in Grand Junction, Colorado. Approximately 20,000 spectators are expected at the three-day metal mining show which will include mining equipment displays, speaker forums, and machinery demonstrations.

The Grand Junction Chamber of Commerce is planning a parade in conjunction with the show and has scheduled a "Miss Atomic Energy" contest, with a 10-ton truckload of uranium ore going to the winner.

Thomas Skidmore is president of UOPA, which has offices in Grand Junction.

ASARCO & Resurrection In Joint Exploration Program

The American Smelting and Refining Company and the wholly owned subsidiary—Resurrection Mining Company—of Newmont Mining Corporation have started an exploration and development program in the Leadville, Colorado mining district.

ASARCO controls a large acreage in the Ibex-Sunday area where diamond drilling from the Eclipse mine workings several years ago disclosed mill grade base metal ore bodies in a down faulted block of Leadville Blue Limestone. Initial mine development to reach this deep ore horizon was through the 650-foot-deep Irene Winze. Later ASARCO collared and sank its Irene No. 2 shaft 1,000 feet from the surface to connect with the top of the winze. Subsequently the shaft was deepened to the 1,750-foot level. In late 1953 because of low metal prices ASARCO suspended all underground work and allowed the lower workings to fill with water.

Resurrection controls and operates the long Yak Tunnel and adjoining mines which border ASARCO's ground on the west and northwest. Resurrection's work in the last year in this area has been limited to several sets of lessees. This new program contemplates connection of the Yak Tunnel with ASARCO's shaft, which will then be drained by pumping to the Yak level, after which a drive is contemplated beneath the Irene ore bodies southerly in the general direction of the Hellena workings of Resurrection. The latter are being extended northerly. The contemplated work will be performed by Resurrection, as Resurrection is in control of both the Yak Tunnel and the Hellena Shaft.

In order to have a second exit from the Hellena workings, it is also contemplated that a hoist will be installed at the old Julia Fisk shaft on the Little Julia claim, provided it is found practicable to repair this shaft.

Little Mo Begins Drilling On Fremont County U-Land

A program calling for 50,000 feet of test drilling on uranium property in the Copper Mountain and Gas Hills area of Fremont County, Wyoming, has been announced by Little Missouri Mining, Inc. of Upton and Riverton.

L. A. Henderson and Allan D. Douglas

The company which owns and has under lease 31 claims in the Copper Mountain area and 24 in the Gas Hills area, started mining March 1st on the Arrowhead No. 1 claim, staked in Sec. 29, T. 40 N., R. 92 W. 6th PM, by Clifford Reed and Chester Fike of Riverton. It is currently producing 20 tons per day of ore with an average grade of 0.25 percent U_3O_8. The ore is being trucked to the new Atomic Energy Commission buying station at Riverton.

Mining is now underway on a face 700 feet long with the ore body being extended daily by drilling. The ore has been identified as uranophane and lies in a decomposed granite as well as in granite schists.

Now in use at the operation, following construction of seven miles of mountain road, are drills, a compressor, a bulldozer, and an endloader for mining, and three prospect drilling rigs, including a core drill with 1,500-foot capacity.

In charge of operations for Little Missouri, which also operates a uranium mine near Devils Tower in northeastern Wyoming, are L. A. Henderson, field superintendent, Allan D. Douglas, president of the corporation, Millard Dickey, mining superintendent, and Lewis Holst, pit foreman.

AEC Holds Hearings On Awarding Mine Leases

Although the United States Atomic Energy Commission has not released its recommendations on the uranium hearings which were held in Grand Junction, Colorado the latter part of March, most spokesmen for the industry seemed to favor continuing the present merit system for awarding leases on government controlled lands.

Suggestions for revision of the selection board included adding representatives from private industry along with AEC officials to the board. Other methods proposed in awarding mining leases included competitive bidding and a lottery system.

Heard at the three-day sessions were 35 representatives from the Colorado Mining Association, Utah Mining Association, New Mexico Mining Association, Arizona Small Mines Operators Association, Uranium Ore Producers Association, and various private uranium companies.

Official recommendations will be made by the AEC at a later date.

COLORADO

A $1,500,000 sulphuric acid plant is now under construction by the *Rico Argentine Mining Company* at Rico, Colorado. With a scheduled initial production of 150 tons per day, the plant is expected to supply uranium mills in southwestern Colorado, which at present have to import supplies of sulphuric acid from Utah. The plant will be completed in August.

National Uranium Corporation, Wallace, Idaho, and *Pathfinder Uranium Corporation*, Salt Lake City, Utah, have started drilling their jointly owned *Jarwell* group of claims 30 miles southwest of Grand Junction. *Lippoth and Wein Drilling Company* has been granted a contract for about 2,500 feet of drilling under the direction of Paul deVergie, Pathfinder geologist. Holes of from 50 to 200 feet in depth will probe the Morrison ore-bearing formation exposed along a mesa rim. The original Jarwell 21-claim group has been expanded to 43 claims through location of ground across the canyon.

Bruster and Gott, Montrose, Colorado cement contractors, are completing work on the *Telluride Mines, Inc.* mill at Telluride, Colorado. The plant is being enlarged by *Idarado Mining Company*, which owns Telluride, after a year-long shutdown in 1954. The new floor for the flotation unit has been poured on a slope to facilitate cleaning up of spills.

Nine claims in Saucer Basin on Club Mesa, Mesa County, Colorado have been leased to the *Ucolo Uranium Company* by Glenn Neesham of Nucla, Colorado. The five year lease calls for 10,000 feet of drilling per year. Ucolo has headquarters in Salt Lake City, Utah and plans to begin its drilling program this month.

Crescent Uranium Mines, Inc., Denver, Colorado, has announced that a deal has been made on its option on 19 uranium claims in western Fremont County, Colo-

rado, with the *J. M. Huber Corporation* of Borger, Texas. The Huber corporation will advance $195,000 to exercise the option in return for an undivided one-half interest in the 19 claims. A five-ton pilot shipment of ore from the mine reportedly had a value in excess of $145 per ton. The Huber Corporation has already moved in heavy machinery at the property and is stockpiling the ore there.

Oceanic Oil Company has formed a subsidiary, *Sierra Uranium Company*, to seek uranium in the Colorado Plateau area.

Atomic Power Uranium Company, Denver, Colorado, is now doing mining and exploration work in the Gateway area, Mesa County, Colorado. L. H. Cullen is president of the company.

A thorium refining plant is scheduled for the Canon City, Colorado area by *American Mineral Development Corporation*. The firm has developed enough thorium to begin milling operations and construction of a plant is planned for the immediate future. The corporation holds leases on 1,320 acres in the Oak Creek district in the same vicinity as several *Climax Molybdenum Company* thorium leases. Partners in the American Mineral Development Corporation are E. W. Ohlson, Jr., M. D. Obele, and E. L. Osborne, Colorado Springs businessmen.

United Uranium Corporation, Denver, Colorado, is among the new uranium firms filing with the Colorado Securities and Exchange Commission. The firm has 25 unpatented mining claims in San Miguel County, Colorado. President of the company is Ray Fahlender.

Thornburg Uranium Mines, Inc., which operates the *Seven Mile* mine properties in Utah of Vance Thornburg, has announced a public stock selling, the first stock issue for the Thornburg brothers on any of their properties. One hundred shares of capital stock, no par value, will be offered at $1,050 a share. The issue reportedly has already been subscribed. A later offering reportedly will be made to the public. The Seven Mile property includes a sizeable blocked out ore body that is still being extended. Other properties of the brothers in Colorado, Arizona, and Utah, are managed by *Uranium Enterprises, Inc.* and have no connection with the stock issue.

Paramount Uranium Corporation of Moab, Utah is completing clean-up work at its mine in Montezuma Canyon, San Juan County, Utah, and expects to begin shipping ore immediately from the *Verdure* drift. Paramount purchased the mine and eight claims known as the *Shumway* group from Mr. and Mrs. Seth Shumway of Blanding, Utah. The mine had produced more than 1,000 tons of uranium-vanadium ore before it was sold by the Shumways.

Atlas Uranium Company, Moab, Utah, has begun a second drift at its *One Chance* mine in Brown's Hole, southeast of Moab in San Juan County. J. C. Burgess, Atlas president, said vanadium showings were found almost at the start of the new drift, 78 feet south and west of the first tunnel. The mine is one of eight claims leased by Atlas from Wade Shupe, Moab, who is driving a drift in the same ore body.

Western Mines Development Company has offered to sell its one-third interest in the *Horn Group* of claims on Calamity mesa in San Juan County, Utah to H. D. Clark and Floyd Hamrick for $13,000 plus a $2,000 option advance. The sale will mean the withdrawal of Western Mines from operation on Calamity Mesa in order to concentrate efforts on other properties. Robert Pruess is manager of Western Mines.

New England Uranium Oil Corporation, Fitchburg, Massachusetts, will start a development program on 1,000 acres of uranium claims in northern Emery County, Utah as soon as weather in the area improves. The company recently purchased 50 claims for $68,000 from J. H. Norton, who will act as manager of the operations. *Pioneer Drilling Company* has been hired to drill 150-foot holes in each of the claims to determine

All New . . .
SCINTILLATION COUNTER
DETECTRON'S DS-235 SCINTILLATRON

- Direct Reading in % of Uranium
- Big 1½" x 1" Crystal
- RCA Photo Multiplier Tube
- 4 Time Constants

Newest of the new . . . just approved after months of rugged tests, the DS-235 features 9 important improvements including new, streamlined design, much greater sensitivity, 45 times more impact strength, new, larger easy-to-read meter and *actual percent reading of uranium*. Tropicalized, water-proofed and shock mounted—also temperature and height-proof. Get a new DS-235 from your Detectron dealer or WRITE direct for details.

THE Detectron CORPORATION

"Guaranteed Performance"

5528 Vineland Ave., Dept. 20, North Hollywood, Calif.
Detectron Makes the World's Most Complete Line of Prospecting Instruments

URANIUM-TUNGSTEN-MERCURY
ZIRCONIUM-ZINC
PROSPECTING INFORMATION! LATEST NEWS AND DATA ON EQUIPMENT AND METHODS.

Ultra-Violet Products, Inc.
Dept. W, San Gabriel, California
Please send me Prospecting information, description of equipment available, and name of nearest dealer.
Name _____
Address _____
City _____ State _____

If you're **ULTRA-VIOLET MINERALIGHT**
prospecting for **anything**, you need a Mineralight.

HERE'S WHY! The Mineralight shows traces not sufficient to excite other responses, and detects minerals which are often found with uranium ore. By itself or teamed with a Geiger or Scintillation Counter, the Mineralight is a must.

Geiger Counters—Scintillation Counters **SEE THE BIG THREE**

Fisher Research Laboratory, Inc.	Precision Radiation Instruments	Detectron Co.
Uranium Scout	Lucky Strike	Geiger Counters
Uranium Scout DeLuxe	Professional	Scintillatron
Count-O-Scope	Scintillator	Scintron
Scintilla-Scope	Royal Scintillator	Nucleometer

Only at your Mineralight dealer can you see and compare all models made by these three leaders in Geiger and Scintillation Counters and get the latest data on uranium prospecting.

ULTRA-VIOLET PRODUCTS, INC.

Contract Core Drilling

Exploration for coal and other mineral deposits. Foundation test boring and grout hole drilling for bridges, dams and all heavy structures.

Core Drill Contractors for more than 60 years

JOY MANUFACTURING CO.
Contract Core Drill Division • MICHIGAN CITY INDIANA

location of ore bodies. The oil company is negotiating for purchase of additional uranium claims in eastern Utah.

Continental Uranium, Inc.'s Continental No. 1 mine and the *Rattlesnake* mine, owned by a Continental subsidiary, shipped a total of $263,051.15 worth of ore to buying stations in January and February. Approximately 1,363 tons of ore from Continental No. 1 were sold in January and 1,905 tons in February. The Rattlesnake mine produced 909 tons in January and 698 tons in February.

Moab Mines, Inc., Moab, Utah, has just acquired an additional 105 uranium mining claims covering 2,100 acres in Grand and San Juan Counties, Utah. Seventy-five of the claims are located over Chinle-Shinarump horizon in the Seven-Mile area. Thirty claims are located over Morrison horizon in the Blanding area, four miles south of the Abajo Mountains. Moab Mines, Inc. also has holdings in the Big Indian area.

Stocks-Gramlich Corporation, with claims in the La Sal Creek area, San Juan County, Utah, has been purchased by the *Nev-Tah Oil and Mining Company* for $900,000. The lease on adjoining claims, held by Clayton Stocks and Doug Tangren, was purchased, also. Nev-Tah plans to complete detailed mapping, purchase equipment, and begin drilling on the property as soon as weather permits. General manager for the operations will be A. L. Damon, Reno, Nevada.

International Smelting & Refining Company, Salt Lake City, Utah will reopen its lead smelter in Tooele, Utah this month. The lead-zinc reduction plant and zinc fuming plant at Tooele are already in operation, and mining activities in the Park City area some 80 miles from Tooele reportedly have picked up enough to warrant reopening of the operation.

Uranium properties in Utah's Big Indian District, San Juan County, have been purchased from Robert M. Barrett for $3,500,000. The properties were acquired by *Wasatch Corporation, Airfleets, Inc.* and *San Diego Corporation*, which own 67 percent of *Lisbon Uranium Corporation*, Salt Lake City, Utah. The property will be vested in Lisbon, which also has completed a merger agreement with *Gateway Mining Company*, Grand Junction, Colorado, resulting in the acquisition by Lisbon of 30 claims on Beaver Mesa on the Utah-Colorado boundary and $110,000 in cash.

WYOMING

Flanders Mining Company, Grand Junction, Colorado, has purchased 125 claims in the Gas Hills region of Fremont County, Wyoming for more than $100,000. Selling the property to Flanders, which has uranium properties on Beaver Mesa in Colorado, was Sam Day, Fort Collins oil and uranium man who earlier had purchased the claims from a group of Freemont County residents. Involved in the transaction were four claims from the *Clark* group, 10 claims from the *Wing* group, two from the *Ruby* group and 100 from the *X* claims. Flanders, a partnership composed of General Frederick L. Anderson, Lee Van Atta, and H. P. Slagel, entered the mining field last year, purchasing the entire assets of the *Gateway Mining and Development Company* last winter.

Lucky Mc Uranium Corporation plans to increase production at its Fremont County properties to 100 tons per day. Output has been running at 35 tons daily. W. H. H. Cranmer, president of Lucky Mc, believes that the operation could produce much more than 100 tons, and the firm is interested in constructing a uranium mill at Riverton, Wyoming. Because Lucky Mc is the largest ore producer in the area, it believes it has good reason to build such a mill and plans to make application to the *U. S. Atomic Energy Commission*. *Vitro Corporation of America* reportedly is also interested in constructing a mill at Riverton.

Homestake Mining Company, Lead, South Dakota, has taken over the holdings of the *Wyute Mining and Exploration Company*, Salt Lake City, Utah, which has claims in Natrona County, Wyoming, four miles east of *Lucky Mc Uranium Corporation*. An option has been taken on the 55 Wyute claims in the Gas Hills district, and Homestake has agreed to pay a gross royalty of 12½ percent, if production results from its holdings. President of Wyute is R. B. Buchman, formerly a vice president of *Kennecott Copper Corporation*.

Payment for the *Ev-Ro* claims purchased by *Mountain Mesa Uranium Corporation*, Casper, Wyoming, was $10,000 plus royalties. Production will start immediately, since sale terms called for initial shipments within 90 days. The property was bought from Harold Evans and Clyde Rowe, who also get royalty rights from the property. Three known ore horizons are located on the property, and preliminary digging has revealed a uranium ore deposit 70 feet wide and several feet thick. In addition to the Ev-Ro claims, accelerated production is expected by Mountain Mesa at its *Blarco* claims, one mile to the southwest. Stripping operations have been carried out for the past month and ore is being shipped to the Riverton *United States Atomic Energy Commission* buying station. Test drilling is also being conducted on the property. Mountain Mesa has more than 200 claims leased throughout the Gas Hills area.

The *United States Atomic Energy Commission* is planning what is believed to be the first deep core drilling program in the Gas Hills and Green Mountain areas of Fremont County, Wyoming. Because of the relative looseness of the sandstones and shale in the area, it has been considered virtually impossible to obtain good cores, and drilling to date has consisted of churn-type methods. *Minerals Engineering Company*, Grand Junction, Colorado, has been awarded the drilling contract. Location of the program in the Gas Hills region is T. 32 and 33 N. and R. 89, 90, and 91 W. In the Green Mountain area it is T. 27 and 28 N., R. 92 W.

Why Search for

URANIUM

with a Horse and Buggy?

THE **New ROYAL SCINTILLATOR**

★ Is more sensitive than any other Scintillator or Geiger Counter
★ Easily detects deeply buried Uranium deposits from ground or air
★ Produces results never before possible
★ Can be used for oil field surveys
★ Made by the manufacturers of the famous "Scintillator"

Dealers Wanted

Contact your nearest dealer or write direct for complete catalog of Geiger Counters, Scintillators and metal locators including the new "Special Scintillator" priced at only $299.50.

PRECISION RADIATION INSTRUMENTS, INC.
2235 MWR So. La Brea Ave., Los Angeles 16, California
Please send Free Catalog.
NAME _____ TITLE _____
COMPANY _____
ADDRESS _____
CITY _____ ZONE _____ STATE _____

WORLD'S LARGEST MANUFACTURERS OF PORTABLE RADIATION INSTRUMENTS
Export Sales Agent: TERMINAL RADIO INTERNATIONAL, LTD.
85 Cortlandt St., New York 7, N. Y. • *Cable Address:* TERMRADIO

U.S.A. Metal & Mineral Prices

METALS

		April 18, 1955
COPPER:	**Electrolytic.** Delivered F.o.b. cars, Valley basis	36.00¢
	Lake. Delivered, destinations, U.S.A.	36.00¢
	Foreign Copper. Valley basis	36.00¢
LEAD:	**Common Grade.** New York	15.00¢
	Tri-State Concentrates, jig, flotation 80% lead, per ton	$187.50
ZINC:	**Prime Western;** F.o.b. E. St. Louis	12.00¢
	Prime Western; Delivered, New York	12.50¢
	Tri-State Concentrate, 60% zinc, per ton	$72.00
ALUMINUM:	**Primary 30 Pound Ingots (99% plus).** F.o.b. shipping points	23.20¢
ANTIMONY:	**Lone Star Brand.** F.o.b. Laredo, in bulk	29.00¢
BISMUTH:	(In ton lots) price per pound	$2.25
CADMIUM	**Sticks and bars.** 1 to 5 ton lots (Price per pound)	$1.70
COBALT:	**97-99%,** keg of 550 pounds (Price per pound)	$2.60
COLUMBIUM:	**Powder** Nom., per pound	$119.25
LITHIUM:	98% (per pound)	$10.00-$13.00
MAGNESIUM:	**Ingots (99.8%)** F.o.b. Velasco, Texas, per pound	28.5¢
MERCURY:	**Flasks.** Small lots, New York	$317.00-$320.00
NICKEL:	**"F" Ingots (5 pounds).** F.o.b. refinery, Port Calbourne, Ontario	64.50¢
TIN:	**Grade A. Brands.** New York (Price per pound) Prompt delivery	92.125
TITANIUM:	**99.3%** + Grade "A" (Price per pound)	$3.50-$3.95
GOLD:	United States Treasury Price	$35.00 per ounce
SILVER:	**Newly mined domestic.** United States Treasury price	90½¢ per ounce
	Foreign Handy & Harmon	87.0¢
PLATINUM:	**Per Ounce**	$76.00-$78.00
ZIRCONIUM:	**Sponge, Per Pound**	$10.00

ORES AND CONCENTRATES

BERYLLIUM ORE: **10 to 12% BeO.** F.o.b. mine, Colorado — $47.00 per unit
Small lot purchases at Custer, S. D., Spruce Pine, N. C., and Franklin, N. H. Visual inspection at $400.00 per short ton or by assaying at: 8.0 to 8.9% BeO, $40 per unit; 9.0 to 9.9%, $45; over 10.0%, $50.

CHROME ORE: F.o.b. railroad cars eastern seaports. Long tons dry weight.
African (Rhodesian). 48% Cr_2O_3. 3 to 1 Ratio — $44.00-$45.00
African (Transvaal). 48% Cr_2O_3. No Ratio — $31.00-$32.00
Turkish, 48% Cr_2O_3. 3 to 1 chrome-iron ratio — $46.00
U. S. Government ore purchase depot Grants Pass, Oregon. Base price, jumpy ore, $115.00; fines and concentrates $110.00 for 48% Cr_2O_3 and a 3 to 1 chromium-iron ratio. Premiums for higher grade ore and for a ratio up to 3.5 to 1. Penalties for grades down to 42% Cr_2O_3.

COLUMBIUM-TANTALUM ORE: At United States small lot beryl purchase depots. $3.40 per pound contained combined pentoxides in 50% ore. Includes 100% bonus.

IRON ORE: Lake Superior. Per gross ton Lower Lake Ports
Mesabi, Non Bessemer, 51.5% Fe. Second quarter — $10.10
Mesabi, Bessemer, 51.5% Fe. Second quarter — $10.25
Old Range Non Bessemer. Second quarter — $10.25
Old Range Bessemer. Second quarter — $10.40
Swedish, Atlantic Ports, 60 to 68% Fe. Contracts, Per Unit — 22.00¢

MANGANESE ORE:
Metallurgical grade. 48 to 50% Mn. Long ton unit — $0.87-$0.90
Metallurgical grade. 46 to 48% Mn. Long ton unit — $0.85-$0.87
Metallurgical grade. 45 to 46% Mn. Long ton unit — $0.75-$0.80
Chemical grade. 80% MnO_2. Per Ton — $70.00
Domestic U. S. Government are purchasing depots: Deming, New Mexico; base price $2.30 per long dry ton unit of recoverable manganese less handling and treating costs. Wenden, Arizona; base price of $8.54 per long dry ton of 15% manganese ore. Butte, Montana; (black and pink ores) base price of $4.87 per long dry ton of 18% manganese ore. Phillipsburg, Montana base price of $6.43 per long ton unit of 15% manganese ore. Small lot program f.o.b. railroad cars, minimum 40% Mn. Base price (48%) $2.30 per unit with premiums and penalties.

MOLYBDENUM CONCENTRATE: 90% MoS_2 F.o.b. Climax, Colorado. Per pound of contained molybdenum, plus cost of containers — $1.05

TUNGSTEN CONCENTRATE:
Domestic. 60% WO_3 Per short ton unit — $63.00-$65.00
Foreign. 65% WO, Per short ton unit (Scheelite) — $29.00
Foreign. South American, Spanish, Portuguese — $27.00-$28.00

URANIUM ORE: **Carnotite-Roscoelite.** F.o.b. purchase depot plus $0.06 per ton mile ($6.00 maximum), Grand Junction, Rifle, Durango, Naturita and Uravan, Colorado Salt Lake City, Marysvale, Thompsons, Moab, White Canyon, Green River, and Monticello, Utah. Shiprock, and Bluewater, New Mexico, Edgemont, S. Dakota, Riverton, Wyoming, and Cutter, Arizona. Base price for 0.10% ore is $1.50 per pound and up to $3.50 per pound of contained U_3O_8 plus $0.75 per pound for each pound in excess of 4 pounds per short dry ton and an extra allowance of $0.25 per pound for each in excess of 10 pounds. A $0.50 per pound development allowance paid on all ore purchases. At Shiprock all ores with more than 6% lime are penalized for excess lime.

VANADIUM ORE: **Carnotite-Roscoelite.** V_2O_5 in ratio of more than 10 parts to 1 part of U_3O_8 are generally acceptable at all AEC depots, but excess not paid for at Marysvale, Monticello, Shiprock, and Bluewater ..... Per Pound V_2O_5 $0.31

NON-METALLIC MINERALS

BENTONITE:
Minus-200-mesh. F.o.b. Wyoming points. Per ton in carload lots — $12.50
Oil Well grade. Packed in 100 pound paper bags — $14.00

FLUORSPAR:
Metallurgical grade. 70% effective CaF_2 content per short ton F.o.b. Illinois-Kentucky mines — $32.00
Mexican. 70% f.o.b. border — $22.00
European, Atlantic Ports, 70% — $30.00
Acid Grade. 97% CaF_2 F.o.b. Kentucky, Illinois, Colorado — $50.00

PERLITE:
Crude: F.o.b. mine per short ton — $3.00 to $5.00
Plaster grades. Crushed and sized. F.o.b. plants — $7.00 to $9.00

SULPHUR: Long ton, F.o.b. Hoskins Mound, Texas — $25.50
Export — $30.50

LONDON METAL AND MINERAL PRICES

		April 18, 1955 Per Long Ton		USA Equivalent cents per pound[1]
COPPER:	**Electrolytic, spot**	£328	0s 0d	41.00¢
LEAD:	**Refined, 99.9%**	£105	5s 0d	13.16¢
ZINC:	**Virgin, 98%**	£ 89	10s 0d	11.19¢
ALUMINUM:	**Ingot, 99.5%**	£163	0s 0d	20.37¢
ANTIMONY:	**Regulus, 99.6%**	£210	0s 0d	26.25¢
TIN:	**Standard, 99.75%**	£722	0s 0d	90.25¢
TUNGSTEN:	**Long ton unit, 243 equivalent** to			$34.02

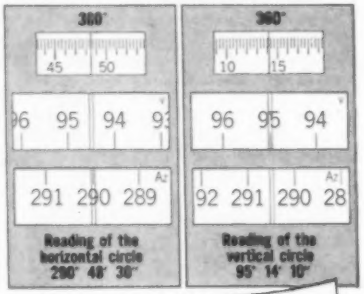
1. With Sterling pound at $2.80.

Quotations on metals and certain ores through the courtesy of *American Metal Market*, New York, N. Y.

AT YOUR REQUEST IT'S HERE...

The NEW 20" Reading WILD HEERBRUGG® T-1 OPTICAL *Repeating* TRANSIT

In answer to many requests, available now as an alternative to the Standard Model (reading direct to 1', interpolation to 6"). The New Model WILD T-1 Optical Repeating Transit gives direct reading to 20" on both circles, easy interpolation to 10" (as shown below).



The WILD T-1, with years of proven service under all field conditions, is the most widely used modern transit because it offers you: - full behind-instrument operation, a built-in optical plummet for fast set-up, an optical micrometer reading system which eliminates possibility of error. It sets on zero and repeats angles. Illumination is provided by daylight mirror or battery attachment for night, tunnel or mine work. Made by the world's largest surveying instrument manufacturers and backed by full factory service here.

T-1 TRANSIT $740
Reading direct to 20 seconds, interpolation to 10 seconds.

T-1 TRANSIT (Standard Model) **$722**
Reading direct to 1 minute, interpolation to 6 seconds.

(All Model Tripods Extra)

PRICES F.O.B. PORT WASHINGTON, N. Y.

For details phone or write for Booklet MW-5

WILD HEERBRUGG INSTRUMENTS INC.
MAIN & COVERT STS., PORT WASHINGTON, N. Y.
PORt Washington 7-4843

Simplot Company Buys Nevada Silica Firm

The J. R. Simplot Company of Boise, Idaho has purchased the Nunn Company of Overton, Nevada, and will operate it as Simplot Silica Products, Inc., a newly formed Nevada corporation.

The Nunn Company has been in operation for the past 20 years, mining, processing, and marketing high-grade silica products. The company plant has a capacity of 10,000 tons per month.

Operating personnel will be headed by Keith Madill as manager, and Don Ferguson as superintendent. All employees of the Nunn company are to be retained.

Another Large Potash Project for New Mexico

Farmers Chemical Resources Development Corporation has been formed by Kerr-McGee Oil Industries, Inc. and National Farmers Union to develop 13,000 acres of potash land in Eddy and Lea counties, New Mexico. Phillips Chemical Company, a wholly owned subsidiary of Phillips Petroleum Corporation, has acquired a half interest in the Kerr-McGee holdings, or a quarter interest in the new firm.

Additional core drilling is being undertaken to test the mining site before shaft sinking operations begin in about three months.

Inspiration May Develop Christmas Copper Mine

Inspiration Consolidated Copper Company may spend between $7,000,000 and $8,000,000 in developing the Christmas mine in the Banner mining district near Winkleman, Arizona. The company has had the property under an 18-month option (since February 1, 1954) from Riviera Mines Company who holds a lease and purchase option on the property from Christmas Copper Corporation.

An intensive program of underground drifting and diamond drilling, both underground and from the surface, was conducted last year at a cost of $345,362. It confirmed theories as to the presence of ore, both near and far below the limit of present workings.

Inspiration has also taken an option on claims owned by the New Year Mining Company, lying to the west of the Christmas property. Preliminary geological studies have been made and other exploratory work will be undertaken later.

At Inspiration Consolidated's own property at Inspiration, Arizona, plans are being considered for a complete revision of its metallurgical process to include both leaching and flotation. In this dual process, the ore would be leached with sulphuric acid to recover its quickly soluble oxide copper content, and then finely ground and subjected to flotation concentration for recovery of copper in sulphide form. The adoption of the dual process would require rehabilitation of the mill, first run in 1915 and operated sporadically since 1930.

Although engineering plans are not complete, the company estimates that an expenditure of at least $3,000,000 may be required for replacement of mill machinery with modern units and to develop sufficient additional water supply.

Mining and stockpiling of uranium ore has started in the Amado area of Arizona where *Utah Construction Company* is undertaking a joint venture with *Comstock Uranium and Oil Corporation* and *Santa Cruz Uranium Company*. (See MINING WORLD, April 1955, page 84.) Open-pit operations on a part of the 20 claims owned by the group brought production of 40 tons of ore. Diamond drilling is continuing on other parts of the claims but results have not yet been revealed. S. A. Walsh is president of Comstock.

The *Sierra Ancha Mining Company*, a subsidiary of the *Pittston Company*, may return the *Red Bluff* mine near Globe, Arizona to its original owners, Ethel Schell Larsen and Carl Larsen. The uranium property was purchased for $210,000—$100,000 in cash and the remainder in installments. The company has asked for an extension of time before paying the latest $55,000 installment and, reportedly, is considering the return of the property. The company drove four drifts on the property and did considerable drilling. An estimated 2,000 tons of uranium ore were mined and stockpiled.

Estella Mines, of Wasa, British Columbia, Canada, has opened a 4½-foot-thick bed of uranium ore at its northern Arizona property. First shipments averaged more than $30 a ton. The firm has a lead-zinc mine 20 miles northeast of Cranbrook, B.C.

Production of uranium ore is reported by *Sterling Uranium Corporation* from its *Trans World* mine in Apache County, Arizona. The mine is located on the Navajo Indian Reservation, adjoining the *Monument No. 2* property of *Vanadium Corporation of America*. The Sterling Uranium Corporation was formed by the merger of four companies, *Trans World*, *Red Man*, *Atomic*, and *National Uranium*. John A. Chambers is president and will direct mining operations.

N. D. Hightower of Phoenix, Arizona is reported to have acquired the Pessin mill near Morristown and started milling of tungsten ore. Feed for the mill is mined by Mr. Hightower at the *Cole* tungsten mine in the Red Picacho district, five miles from the mill, and consists of both scheelite and powellite. Mining is by surface methods.

Present plans are said to call for completion of the Humboldt reduction and chemical plant at Humboldt, Arizona, by July 1. The plant is being erected by Archie L. Poarch of Prescott and associates for the treatment of low-grade material, primarily mill tailings. So far, six buildings have been erected at the old Humboldt smelter site. Their construction required the leveling of the old Humboldt smelter stack built by *Consolidated Arizona Smelting Company* in 1889 and Arizona's oldest landmark of its type.

Like Texas, Arizona is attempting to settle a conflict between uranium prospectors and ranchers. (See MINING WORLD, March 1955, page 90.) The State Land Commissioner has warned mining claim locators that they face cancellation of their leases if they cross out makeshift roads at random across public or privately owned leased land without approval from

$25,000,000 Lavender Pit of Phelps Dodge

The nation's third post-Korean copper project—and the largest of the three—is shown above. This is the Lavender open pit of Phelps Dodge Corporation at Bisbee, Arizona, which went into production with official dedication of the open-pit mine and plants on August 7, 1954. By the end of that year, 1,671,753 tons of ore had been mined and milled. The project was undertaken in 1951 when stripping was started. A total of 51,338,599 tons of waste had been removed by December 31, 1954. The pit is more than two-thirds of a mile long, and about a half mile wide. The ore is mined in benches. Located on the far edge of the pit in the center background of the picture above is the primary crusher to which trucks haul and dump the ore. Crusher undersize is elevated by belt conveyor to the coarse ore storage bins, and then by second conveyor to the fine crushing section and on to the flotation plant. Concentrate is shipped by rail to the company's smelter at Douglas, and blister copper is then sent to the electrolytic copper refinery at El Paso, Texas. The pit was named for the late Harrison M. Lavender, former manager of Phelps Dodge operations at Bisbee.

the State Land Department. Cattlemen are reported to be patrolling their property with shotguns to prevent further destruction of valuable grasslands by irresponsible prospectors.

San Manuel Copper Corporation's new 500-foot smelter stack should be completed shortly by *Custodis Construction Company* at San Manuel, Arizona.

A number of lease and purchase options on uranium claims have been filed with the Gila County recorder, according to reports in Globe, Arizona. Among these is an agreement wherein Fred W. Rich of Salt Lake City, Utah, has acquired 17 claims in the Green Buck mining district from Leck Cline, G. E. Toot, W. M. Packard, and Joe Cornett, all of Tonto Basin. In a similar agreement, Sherwood B. Owens of Tucson acquired 15 claims in the El Capital district from George Angius of Miami and D. N. Zenovich of Globe. Other transactions cover the leasing of six claims from various owners by Gus Karrington of Hollywood. Monthly payments, plus royalties, are specified in most of the leases.

California Quicksilver Mines, Inc. reported a net profit of $238,135 in 1954 brought about largely through the mining of a high-grade pocket at a time when prices were record high. The pocket yielded 1,100 flasks of mercury during a three-month period, with a single furnace treating about 30 tons of ore a day. Since then, ore has been of average grade, with a total of 9,764 tons of ore furnaced during the entire year to yield 2,195 flasks of quicksilver, for an average of 17.09 pounds per ton of ore. A second furnace is ready to go into operation, and mill capacity has been increased from 40 to 80 tons a day this year. The production goal is set for 3,000 flasks. Ore will come from an ore body located while working under a Defense Minerals Exploration Administration contract. Value and extent of the deposit have not been determined.

A group of Susanville, California men have optioned the *Lucky Day* and *Valley View* groups of uranium mining claims to *Western Development Corporation*, a subsidiary of the *Helene Curtis Enterprises*. The men were the Purdy brothers, Paul Langslet, and H. N. Stewart. The property is northeast of Hallelujah Junction, between the *Buckhorn* property recently sold to the E. L. Cord interests, and the *Cornelius C.* claims on the north, also under option to Western Development. The latter is reported to have built a road from Highway 395 to the Cornelius C. property and is currently stripping overburden.

Uranium has now been reported in San Bernardino and Inyo counties, California. Almost 1,000 claims were filed in the San Bernardino County Recorder's office in the first 15 days of March. In Inyo County, a group of Ontario businessmen, known as *Ontario Minerals Company*, have reported a uranium find in the Owens Lake area near the town of Olancha. They have staked 156 claims.

The first uranium mining claims suit to reach the Kern County Superior Court involves *Verdi Development Company, Inc.* and Mr. and Mrs. Roy H. Tull of Rosamond, California versus *Dono-Han Mining Company* and its officials. The plaintiffs seek a permanent injunction restraining Dono-Han from entering a quarter section of land five miles west of Rosamond. The Tulls claim they purchased the land two years ago and leased it to Jesse M. Ashby, vice president of Verdi, last March. The defendants say they staked claims more than a year ago, have dug a shaft and stockpiled ore. Verdi has been operating in the Rosamond area for some time and holds more than 2,000 claims.

The Holmes brothers have reopened the old *Amador Queen* and *Amador* gold mines south of Jackson, California, under an agreement with Thomas and Steel, the owners. This historic area was once the scene of million-dollar gold operations. The Holmes brothers are concentrating work on the *Kruger* quartz claim of the group.

A new company, to be known as *Uranium-Thorium, Inc.*, is reported to have purchased 23 uranium claims in the Blythe area of Riverside County, California. Roger Walch, former district attorney of Kings County and Rex McCartney of Hanford, Kings County, California, are associated in the venture.

Great Lakes Carbon Corporation has leased the perlite mine and plant of *California Perlite Corporation* at Klon-

DIAMOND DRILL BITS
POWDERED METAL
Special tungsten alloy powdered metal matrix to meet all drilling conditions. Bit crowns sintered onto blank bits in one operation.
Diamonds for mineral boring . . . for prospecting.
Choose the RIGHT matrix hardness for YOUR job!
ASCOLITE bits... 55 to 60° hardness
NICOLITE bits... 40 to 45° hardness
BRONZOLITE bits 18 to 24° hardness
*On Rockwell "C" scale
Drill bortz and cast in all sizes and prices.
Brazilian ballas and carbons.
ASCOLITE reaming shells
Price catalog on request
EST'D 1908 ANTON SMIT & CO., Inc.
333 W. 52nd St., New York 19, N. Y. • Cables: PROFITABLE, New York

★ OFFICES
• DEALERS
SPOKANE ★
★ SEATTLE
YAKIMA ★
KENNEWICK ★
★ PORTLAND
★ MEDFORD
EVERYTHING for WELDING and CUTTING ...no further away than your phone!
Distributors of GE WELDING PRODUCTS
Faster, better service made possible by the convenient location of an Indair dealer near your business. Dial Indair for your welding and cutting needs.
Manufacturers of OXYGEN ACETYLENE NITROGEN ARGON HELIUM MEDICAL GASES
INDUSTRIAL AIR PRODUCTS CO.
1940—1955 OUR 15th YEAR OF PROGRESS
PORTLAND SPOKANE SEATTLE
YAKIMA MEDFORD KENNEWICK

dike, California, with an option to purchase. California Perlite has been producing and selling 800 tons of the material per month. Great Lakes plans to triple this figure during the next five years. The company also operates mines at Socorro, New Mexico, and Rosita, Colorado.

The *Banner Hill Uranium Company* of Bishop, California will establish an office at Tonopah, Nevada where the firm will seek favorable mining property. Banner owns seven uranium claims in Mono County, California. Formerly called the *Wild Bill* claims, they have been renamed the *Wildcat* group. William Fischer is president of the company; Ray Havrey is vice president; and Patrick Kane is secretary-treasurer.

The Tonopah area of Nevada has been almost completely encircled for a 50-mile radius by claims staked by uranium prospectors. One group of claims, owned by Walter Bowler, has shown excellent surface indications. Drill holes are being sunk to determine values at depth.

Consolidated Eureka Mining Company has discovered an ore zone in drifting east on the 320-foot level of its mine at Eureka, Nevada. The drifting was started in order to bypass the present high-grade lead-silver-gold ore body on the north end of the level so that exploration in the Hamburg formation could be continued. Extent of the new discovery and its value are yet to be determined.

The crosscut being driven to connect the Deep Ruth and Kellinske shafts has been completed at the *Kennecott Copper Corporation's* project at Kimberly, Nevada. The contractors were *Foley Brothers* who have been operating under contract for three years. The crosscut will be the main operating level.

Three recent DMEA contracts went to the following Nevada operations: *Tungsten Mountain Mining Company*, $32,268 for tungsten in Churchill County, the government's share $24,201; *Platora Uranium Corporation*, $20,750 for uranium in Humboldt County, government's share $15,563; *Kaiser Aluminum & Chemical Corporation*, $5,020 for fluorspar in Lander County, government's share $2,510. Under its contract, Platora sank a 260-foot shaft and drifted for 500 feet on the bottom level. Work revealed a large fault zone with various areas showing uranium from 0.06 to 0.56 percent U_3O_8; however, it was all meta autunite and in a badly leached zone. Now they have opened a flat dipping vein about four feet wide showing torbernite. Kaiser's exploratory work under the contract has been completed, and did not reveal any commercial fluorspar deposits.

High-grade manganese ore is reportedly being mined from the *South Paw* mine in the Irish Mountain district, Pahranagat Valley, Lincoln County, Nevada. The ore, reportedly assaying 40 percent Mn, is being shipped to the government's purchasing depot at Wenden, Arizona. The mine is owned by Mrs. Ora S. Tuttle, Dick Arnold, and Mrs. Lavern Stewart. It is under lease to a joint partnership of *Combined Metals Reduction Company* of Pioche and P. W. Duffin Sr. of Las Vegas. Don Hone and the Somers brothers operate the property for the lessees.

Combined Metals Reduction Company is experimenting with a new method of treating its manganese ore. Alterations have been made in the mill to treat the ore by gravity concentration instead of the present flotation methods. Rotary deep hole drilling is currently being undertaken by the *Exploration Drilling Company* of Santa Fe, California under contract. The program will involve a number of locations, with the current work being done on the south extension of the Prince mine ore channel.

The *Westvaco Mineral Products Division* of the *Food Machinery and Chemical Corporation* has leased a large barite deposit near Battle Mountain, Nevada from the *Glidden Company* of Cleveland, Ohio. The property will be operated in conjunction with other Westvaco properties in Nevada which serve the firm's barite chemical plant at Modesto, California.

The *Standard Slag Company* has taken an option on a bond and lease on the *Betty O'Neal* silver mine from M. S. Fisher of Battle Mountain, Nevada. Standard plans geophysical exploration work followed by diamond drilling. The Betty O'Neal is located 13 miles southeast of Battle Mountain. It was oper-

ONE POINT OF IGNITION

This means added *safety* in your blasting operations. And you get it with Coast's SPITTERCORD —the fuse spitting and timing device that cuts time at the face, permits consecutive lighting of all safety fuses of a round, and assures accurate control of hole firing order. SPITTERCORD will help make your blasting safer and will provide greater efficiency.

PRIMACORD - BICKFORD
Hot Wire Fuse Lighters
Detonating Fuse
Safety Fuse
Celokap

COAST MANUFACTURING & SUPPLY COMPANY ESTABLISHED 1867 LIVERMORE CAL.

Ask your powder supplier or write for literature

COAST MANUFACTURING & SUPPLY CO.
LIVERMORE, CALIFORNIA

GEIGER & SCINTILLATION COUNTERS

THE VERY BEST IN FIELD RELIABILITY, SENSITIVITY, LINEARITY, CONSTRUCTION, OVERALL PERFORMANCE

★ NEW URANIUM SCOUT Series Field Geiger Counters.
★ NEW Premium Scintillation Counters.
★ NEW Field Geiger Counter-Digit Scaler. Records Counts for 30 or 60 Sec. Interval.

SEND FOR NEW 1955 CATALOG

FISHER RESEARCH LABORATORY, INC.
Dept. B
1963 University Ave. Palo Alto, Calif.

FEEDOWEIGHT

A self-contained conveyor feeder scale that feeds, weighs and totalizes. Use the Feedoweight for better control of ball mill grinding. It accurately controls FEED by WEIGHT, automatically. Made in sizes to meet all tonnage requirements.

MERRICK SCALE MFG. CO.
172 Summer Street
PASSAIC NEW JERSEY

PROFESSIONAL DIRECTORY

One-Inch Card, $50 Yearly—½-Inch, $35 Yearly. Payable in Advance.

CONSULTING ENGINEERS:

COWIN & CO., INC.
Mining Engineers and Contractors • Consulting Appraisal Reports • Shaft & Slope Sinking • Mine Development • Mine Plant Construction.
2-18th Street, S. W. Birmingham, Ala.
Phone 56-5566

DICKINSON LABORATORIES
Assayers—Chemists—Metallurgists—Umpires
Shippers Representatives at Local Smelters
Representatives at Mexican Border
Points for Shippers of Manganese and Fluorspar
1300 West Main Street — El Paso, Texas

C. P. KEEGEL
Mining & Metallurgical Engineer
Administration — Appraisal
707 S. 6th St. — Tel. 571
Las Vegas, Nevada

ARNOLD H. MILLER
CONSULTING ENGINEER
General Mine, Mill and Industrial Appraisals, Plant Design, Mechanization.
Cable: "ALMIL" — Tel. Cortland 7-0635
120 Broadway — New York City 5, N. Y.

MURPHY, F. M.
Consulting Mining Geologist
1201 Maryland Parkway, Las Vegas, Nev.

RODGERS PEALE
Consulting Mining Geologist
315 Montgomery St. — San Francisco 4, Calif.

WILLIAM J. SHEDWICK, JR.
Mine and Geologic Reports
Mexico and Latin America
New Jersey License 2744-a
Reforma 20-302 — Mexico 1, D. F.

ARTHUR R. STILL
Consulting Mining Geologist
Room 24, Union Block — Prescott, Arizona

MARVIN J. UDY
Inorganic Chemistry — Electrochemistry
Electric Furnace Smelting
Process Metallurgy
Ferro-Alloys, Calcium Carbide, Phosphorus
546 Portage Road — Telephone 2-6294
NIAGARA FALLS, N. Y.

URANIUM EXPLORATION
Mining, Geology, Reports, Surveys
GEO-ENGINEERING
Louis P. Gaggini, Lewis D. Anderson,
Harold A. Culp & Associates

Norwood, Colo.	Grand Jct., Colo.
PO Box 223	304 Main Street
Phone: 99	Phone: 3663

PHILIP L. JONES
Consultant
Mineral Economics & Mineral Dressing
Heavy Media Specialist
405 Miners Bank Bldg. — Tel. MAyfair 3-7161
Joplin, Mo.

MILL DESIGN & CONSTRUCTION
Send for Free Bulletin
O. W. WALVOORD CO.
401 High Street • Denver, Colorado

CLIFFORD R. WILFLEY
Mining Engineer
Consulting
2233 Grape St. — EAst 0398
Denver 7, Colorado

CHEMISTS, SAMPLERS, SHIPPERS' REP'S:

ARIZ. TESTING LABORATORIES
CLAUDE E. McLEAN, REGISTERED ASSAYER
Analytical and Consulting Chemists
Box 1888 — 817 W. Madison St. — Phoenix

B. W. DEASON — V. E. WORSLEY
BLACK & DEASON
Assayers and Chemists
Ore Shippers Represented at all Smelters
P. O. Box #1888 — Salt Lake City, Utah

THE COLORADO ASSAYING CO.
ASSAYERS, CHEMISTS, and SPECTROGRAPHERS
Est. 1900
Gold, Silver each $1, both $1.50, Copper 75c. Send for Free Copy of our Mineralogist's Pocket Reference Giving Detailed Information on All the Principal Ores.
2013 WELTON ST., DENVER 1, COLORADO

T. G. Deggendorfer
Shippers' Representative
Control Assays
Box 840 — Kellogg, Idaho

GOODALL BROTHERS
ASSAYERS AND CHEMISTS
SHIPPERS' REPRESENTATIVES
Helena — Established 1909 — Montana

HANKS, INC., ABBOT A.
ASSAYERS AND CHEMISTS
Supervision of Sampling at Smelters
Spectrographic Analysis
624 Sacramento St. — San Francisco 11

HAWLEY & HAWLEY
W. E. HAWLEY, Mgr.
Assayers, Chemists, Ore Buyers
Shippers' Representative
P. O. Box 1060 — Douglas, Arizona

LEDOUX & COMPANY
Chemists Spectroscopists Assayers
Shipping Representatives at Seaports and Refineries in the United States
Mine Examination Analyses
359 Alfred Avenue — Teaneck, New Jersey

SMITH-EMERY COMPANY
Established 1910
Assayers—Chemists
Metallurgists
Spectrographers
Shippers' Representatives
Price List on Request
781 East Washington Blvd., Los Angeles, Calif.

Wood Assaying Co., Henry E.
Established 1878
ASSAYERS and CHEMISTS
733 W. Colfax — Denver 4, Colorado

PRODUCTS AND SUPPLIES:

VAN WATERS & ROGERS
Flotation Chemicals, Mining Reagents
Largest and Most Complete Stocks in Northwest
Seattle, Spokane, Portland, Boise

SCANDINAVIAN ORE TANKERS, INC.
Public Ledger Bldg.
Philadelphia 6, Pa.
COMBINATION ORE and OIL CARRIERS.
MOST ECONOMICAL TRANSPORTATION AFLOAT. INQUIRIES INVITED

DRILLING COMPANIES:

NEW YORK-ARIZONA DEVELOPMENT CORP.
Diamond Core Drilling
614 Mayer-Heard Building — Box 347
Phoenix, Arizona — Globe, Arizona
Phone Alpine 2-8614

MOAB DRILLING COMPANY
Diamond Core Drilling Contractors
"Uranium Exploration is our Business"
Albert Hbacek, Jr., General Manager
52 E. Central Street — Box 387
Phone 4181 — Moab, Utah

R. S. McClintock
Diamond Drill Company
Spokane, Washington—Globe, Arizona
Diamond Core Drill Contractors
Manufacturer of Diamond Bits and drilling accessories

ated from 1919 until 1931, under the managership of N. H. Getchell, as the *Betty O'Neal Mines Company*. The mine was closed when the price of silver dropped to the low point of 1931.

NEW MEXICO

McKenzie & Whittle of Dallas, Texas have been awarded the contract to sink two shafts at the *National Potash Company* project 32 miles east of Carlsbad, New Mexico. The firm is a joint operation of the *Freeport Sulphur Company* and *Pittsburg Consolidation Coal Company*. (See MINING WORLD, April 1955, page 83; March 1955, page 43.)

Sandia Exploration Company of Albuquerque has optioned its 29 uranium claims southeast of Cuba, New Mexico to the *Desert Mining Company*. The latter is now building access roads and doing exploration and development work on the claims.

International Minerals & Chemical Corporation is spending approximately $1,000,000 on an expansion program designed to increase the company's potassium sulphate production by 100 tons a day. Engineering and construction work is being handled by *Stearns-Roger Manufacturing Company* of Denver, with J. H. Jenkins of International's staff as project engineer.

Victory Exploration and Mining Company is reported to be stockpiling uranium ore at Farmington, New Mexico prior to shipping to the AEC mill at Shiprock. The company holds 500 acres near Farmington, and reports indications of commercial ore over the entire property.

Chapman & Wood, consulting mining engineers of Albuquerque, New Mexico, are doing exploration and development work on the *Davis* claims northwest of Prewitt and west of the *Haystack Mountain Development Company's* claims. The deposits occur in Todilto limestone, as at Haystack, and were located with a scintillometer in a surface survey.

Caballo Manganese Company has moved its headquarters from Albuquerque, to Truth or Consequences, New Mexico. Guy M. Shockley, general manager, says that a number of claims east of town will be core drilled. *Western Machinery Company* of San Francisco, California, is doing the research work.

The *Reynolds Drilling Company* of Abilene, Texas reportedly will explore the Laughlin Park area southeast of Raton, New Mexico for uranium.

Missouri Uranium Corporation has been formed by a group representing the contracting and heavy equipment industry in the midwest. They have acquired lease of more than 57,000 acres and nearly 3,000 claims in New Mexico. They plan to engage in three distinct kinds of operation: removal of ore from proven ore bodies under operating contracts with the owners; the actual mining, production, and sale of ores from the firm's own claims and permits; and the sale of claims and permits to individuals, partnerships, and corporations. Raymond E. Blair is president of the new group.

TEXAS

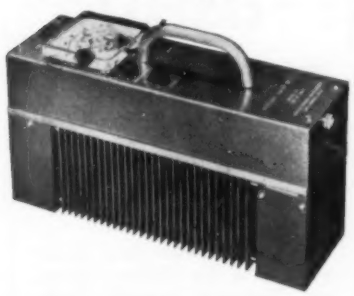
Standard Sulphur Company's new $1,500,000 sulphur plant now under construction should be in full operation by fall. It is expected to add another 200 tons a day to the daily rate of production bringing the total output of Standard Sulphur at both domes to about 600 tons a day. (The plant at Damon Mound has a capacity of 200 tons and additional equipment recently installed will add another 200 tons daily to that operation.) Standard Sulphur has development rights over nearly 1,000 acres on the Allen Dome in Brazoria County, Texas, and it is this area which will supply the new plant.

Carnotite has been discovered five miles north of Lajitas in southern Brewster County, Texas on ground belonging to the Universal Service Mining Corporation. Samples have been sent to the Dickinson Laboratories in El Paso.

Experienced miners are being sought for the *Fresno* mercury mine near Terlingua, Brewster County, Texas, where current production of about one flask per day is to be increased. Mercury miners left the district when the mines closed after the war with a severe drop in mercury prices.

mercury vapor detector

tells instantly when a hazard exists in plant or lab atmospheres



Meter is calibrated in mercury concentrations for quick indication. The toxic limit is a full-scale reading on the high sensitivity scale of Model 23, illustrated. Wt.: 7 lbs.; size 13" x 8½" x 4½". Three models for varying ranges.

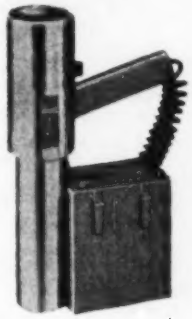
Write for bibliography on the mercury vapor hazard, and literature on Kruger Mercury Vapor Meters.

HAROLD KRUGER INSTRUMENTS

BOX 164 • SAN GABRIEL, CALIF.

SCINTILLATION COUNTERS

FIND URANIUM 100 TIMES EASIER



MODEL 111 (pictured above) . . . $495.00
FAMOUS HALROSS MODEL 939 . . 975.00
AIRBORNE OPTIMUM MODEL SAB-7 . 2810.00

• • • • •

ALL TYPES GIEGER COUNTERS
ULTRA VIOLET LIGHTS
SPECIAL LONG PROBE SCINTILLATION AND GIEGER COUNTERS FOR DRILL HOLES

• • • • •

ENGINEERS SYNDICATE, LTD.
5011 Hollywood Boulevard
Hollywood 27, California
OLympia 2167

POSITIONS OPEN

MINE SUPT., E. M., fgn.	$12,000
MINE SUPT., E. M., U. S.	$600
ASST. MINE SUPT., E. M., fgn.	$550
GEOLOGISTS, (3) mining exp.,	$350-$500
MINE foremen, fgn., (2)	$435-$550
JR. MINE engr., Colo.	start $350
MINE SURVEYORS (2) Colo.	$400
MINE SHIFT boss, U. S.	$450
JR. MINE ENGRS., fgn. & U. S.	$400
JR. MINE or Met. engr. mill exp.	$375-$400
MINE F'man, E. M.'s or practical, fgn.	$450
MILL FOREMEN, fgn. (2)	$425
GEN'L MILL F'man, fgn.	$450
CRUSHER engr. mine or mech. expd.	$600-$700
COMBUSTION engr. mech. or elect.	$9-$11,000
MAINTENANCE mill, smelter, fgn.	$500-$600
DRAFTS. mine mill, fgn.	$600
DRAFTS. mine, mill, Colo.	$450
METAL'GISTS (2) mill and kiln exp.	$6-$6,600
METALLURGIST or chem. engr. S. W.	$440
METALLURGIST, research, U. S.	to $550
MET. ENGR. mech. or crusher exp. fgn.	$5-$600
METALLURGIST, chem. & pyro exp.	OPEN
REVERB. & converter f'man, fgn.	$500
ASST. CHF. mech. engr. crushing, Colo.	$600
MECH. ENGR. supt. testing lab., U. S.	$600
ENGRS. met. chem. mech.	$378-$700
MECH. ENGR. R.R. exp., fgn.	$400-$500
MECH. ENGR. mine exp. fgn.	$800
MECH. ENGR. concentrator, U. S.	OPEN
ASST. CHIEF MECH. engr., fgn.	OPEN
PROJECT engr. metal extrusion	OPEN
ASST. electrical supt. mine, fgn.	$675
ELECT. ENGR. metal produc'n, U. S.	OPEN
E. E., M. E. A. const. mtce.	$500
ELECT. ENGR., electronics	$400-$500
CHF. POWER plant opr., fgn.	$650
ASST. MASTER mech., fgn.	$550
CHEM. ENGRS. (2) research & develop't	$550-$600
CHF. CHEMIST, fgn.	$800
ASST. CHF. chemist, analytical lab.	$500
CHEMISTS, U. S.	$400
ASSAYER, fgn.	$350
CIVIL ENGR., R. R. exp., fgn.	$500
JR. ACCOUNTANT, mine, fgn.	$400 up

GLENN B. WILSON
EMPLOYMENT SPECIALISTS
306 CONTINENTAL OIL BUILDING
DENVER 2, COLORADO

MINING, MILLING AND OPERATING MACHINERY, EQUIPMENT AND SUPPLIES OF THE PINE TREE, JENNY LIND AND HARVARD MINES, CALIFORNIA

FOR SALE BY

PACIFIC MACHINERY & ENGINEERING CO.

420 Market Street—PH. SUtter 1-3943—San Francisco 11, California

Following are major items now available for prompt delivery at attractive prices:

AIR COMPRESSORS

877 cu. ft. I.R. X.C.B. 2 stage w/150 HP G.E. motor.
741 cu. ft. C.P. Mod OCB 225 RPM 2 stage.
695 cu. ft. I.R. type XRB 2 stage w/100 HP motor.
464 cu. ft. C.P. Mod OCB 14"x12".
600 cu. ft. I.R. type XB-2 w/100 HP motor.
387 cu. ft. G.D. Ty. WBH 4001 w/75 HP motor.
385 cu. ft. I.R. Imp. type XB-10 w/60 HP motor.
285 cu. ft. G.D. WBO 4008 w/50 HP motor.
315 cu. ft. Semi Portable Shramm diesel.

CONCENTRATING TABLES

3— No. 6 Wilfley

CAPACITORS

1— 120 KVA 460 volt G.E. type CH-1-3 phase.
1— 30 KVA 460 volt 3 phase G.E. type CH-1.

CLASSIFIERS

6'x25' Dorr Mod 63—Duplex w/5 HP motor.
54"x18' Dorr Mod C Duplex w/3 HP motor.
5'x14' Hardinge Counter Current w/5 HP motor.
27"x16' Dorr Mod D Simplex

CRUSHERS—JAW

15"x36" Cedar Rapids w/60 HP motor VB drive.
20"x10" Pacific Alley w/25 HP motor & drive.
9"x15" Allis Chalmers
8"x15" Pacific Alleys

DRILLS, DRIFTERS, STOPERS, JACKHAMMERS, large stock including Drill tool, Timken and I.R. Bits, Columns, Bars, Arms and Clamps.

DIESEL ELECTRIC GENERATING PLANTS

37½ KVA G.E. 3 phase 220/440 volt dir. con. 50 HP International Mod. PD-40 Mtd. on skids.
15 KW 3 phase Palmer Gen. Dir. Con. to Cat. Diesel Mod 4400.

FLOTATION CELLS

4— 2 Cell Units Fagergren 56"x56" w/7½ HP motors.
2— 3 Cell Units Fagergren 66"x66" w/15 HP motors.
2— 1 Cell Units Fagergren 44"x44" w/5 HP motors.
1— 2 Cell Pan America 48"x48" w/15 HP motor dual VB drive.
1— 36"x36" Denver Sub A unit cell w/7½ HP motor.

FILTERS

1— 11'6"x14' Olive Acid proof w/Vacuum equipment and accessories
1— 4'-3 leaf American w/gear motor drive, Vac. Eqt. etc.

HOISTS

150 HP D.D. Mine type Herringbone gears, Post Brakes, Depth indicators, G.E. motor and Master Control Panel.
75 HP D.D. Ottumwa, post brakes, var. spd. mtr., Rev. Control Panel.
50 HP S.D. Ottumwa w/var. spd. mtr. and controls.

Large stock AIR HOISTS, I.R. Mod. DU-EU-HU, SULLIVAN Mod. F211

HEAD FRAME

56' Steel with 56" heavy duty sheaves for ¾" rope.

LAMPS—MINERS CAP EDISON

54— Electric cap lamps Mod. K w/3 cell approved Edison Batteries, G.E. Tungar rectifier Mod. 6-115 volt AC-DC, charging rack 60 lamp capacity, 3 MSA control panels, cables, Mod. E battery filler, etc.

BALL MILLS

8'x30" Hardinge Conical Ball Ill, good liners and 1 extra set NEW Manganese Steel liners w/150 HP slipring motor, VB drive and control.
7'x36" Hardinge w/good liners 100 HP slipring motor and control.
6'x4' Union Iron Works good liners and 75 HP motor and control.
5'x4' Marcy good liners.

MAGNETIC PULLEY

20"x20" Dings Magnetic w/2 KW 115 v., D.C.M.G. set.
12"x18" Dings Magnetic w/2 KW 115 v., D.C.M.G. set.

POWER UNIT

1— D-7700 Caterpillar Diesel Unit, Twin Disc, clutch and power take-off, 50 HP.

PUMPS

Large stock centrifugal, Sand and Tailings Pumps.

TRANSFORMERS

3— 250 KVA 12500 to 2300/460 volt, G.E. form KDD
3— 50 KVA 2200 to 480 volt, G.E. type H Form K
3— 25 KVA 11000 to 2300/460 volt G.E. Form KB
4— 5 KVA 440 to 220/110 volt G.E. type H Form K

FEDERAL PIPE & TANK CO.

—WOOD PIPE and WOOD TANKS—

Factory
and Main Office
6851 E. Marginal Way
Seattle 8, Wash.

Rod Mill 4½x10 ft. Marcy type, with new liners.
Thickener 28x10 ft. Dorr Ty. A with steel tank, low-head steel superstructure, enclsd gear & gearmotor.

Paul F. Smith

39 W. Adams St. Phoenix, Arizona

DIAMOND DRILL

Contracting Company

S. 18 Stone Spokane 15, Wash.

"DIA-HARD" CORE BARRELS AND DIAMOND DRILLING SUPPLIES

Core and Churn Drill Contractors

BARGAINS

1—16" Superior McCulley Crusher with complete set of spare parts. Like new.
1—Champion Jaw Crusher.
1—42" x 42" Magnetic Cobber (Dings).
1—12" x 6' Oliver Filter complete with spare parts.
1—18D Rotary Vacuum Pump
1—Bucket Elevator complete with spare belts and parts.
6—Hummer Screens complete with spare parts.
1—Railroad Type Motor Car.
1—Air conditioning Unit.
1—2263 Gal. Fresh Water Tank.
2—Synchronous Converters.
1—Ingersoll Rand Bit Quenching Machine.
1—Ingersoll Rand J.M.B. Jackmill, complete.
1—Ingersoll Rand "J.F." Jack Furnace.
1—Ingersoll Rand Automatic Bit Grinder—Direct Motor Driven with many new grinding wheels.
6—Ingersoll Rand Jack Hammers.
2—Ingersoll Rand Busters.
2—Ingersoll Rand Drifters.
2—Worthington Air Pumps.
1—500 Amp. Westinghouse A.C. Welder.
150—Mine Dry Baskets complete with Accessories.
1250—New 3" Steel Balls for Ball Mill.
4—103" Dia. Head Frame Pulleys, complete with bearings.

We also have a large assortment of gear reducers, electric hoists, water pumps, compressors, new and rebuilt electric motors of all voltages and hundreds of other items.

RUDERMAN MACHINERY EXCHANGE

GOUVERNEUR, NEW YORK
Telephone 333-334

FOR SALE
OR LEASE AND OPTION

Mining Property—Gold, silver, lead and zinc. Productive record. Need development. Good Terms.

PAUL CHRISTOPHER

Box 293 Battle Mountain, Nev.

ALLISON STEEL MANUFACTURING COMPANY

Mine and Mill Buildings • Mine Rails • Ore Cars • Steel Gallows Frames • Ball Mills • Muck Plates • Crucible Drill Steel

We offer a complete repair service to the Mining Industry. Our new Machine Shop is equipped to handle your work quickly and economically.

Hot Milling of All Types of Detachable Bits

SOUTH 19TH AVENUE
PHOENIX ARIZONA
PHONE ALpine 8-7731

THE MARKET PLACE

SELECT YOUR EQUIPMENT NEEDS FROM THE LARGE STOCK OF DEPENDABLE RECONDITIONED MACHINERY.

FLOTATION MACHINES
1—New Morse "Jetair" 6 cell #7
1—New Morse "Jetair" 2 cell #7
1—Fagregan Single cell
1—6 cell 18" Stearns-Roger
2—6 cell Denver "Sub A" #21

FILTERS
1—3' x 3' Drum Filter
2—4' x 2' Morse Drum Filters
1—6' 2-disc American Filter
1—6' 3-disc American Filter
1—18" Morse Round Pattern Filter Press
1—36" Merrill Triangular Filter Press
1—12# Sweetland Filter Press. 36 leaves

BALL & ROD MILLS
1—4' x 3' Marcy Ball Mill
1—4' x 3' Morse Ball Mill
1—4' x 4' Marcy Ball Mill
2—6" x 48" Hardinge Conical Ball Mills
1—8' x 22" Hardinge Conical Pebble Mill
1—3' x 8' Marcy Rod Mill
1—3' x 9' Ruth Rod Mill

COMPRESSORS
1—64 CFM Gardner-Denver, 4½" x 4"
2—88 CFM Ingersoll-Rand, 7" x 5"
1—121 CFM Gardner-Denver, 8" x 6"
1—173 CFM Chicago-Pneumatic, 9" x 8"
1—173 CFM Ingersoll-Rand, 9" x 8"
1—179 CFM Ingersoll-Rand, 12" x 10"
1—213 CFM Blaisdell, 14" & 9" x 8"
1—230 CFM Gardner-Denver, 8" & 4¾" x 5"
1—447 CFM Ingersoll-Rand, 14" & 7½" x 12"
1—637 CFM Sullivan, 14" & 8¾" x 10"
1—698 CFM Union, 16" x 12"
1—800 CFM Ingersoll-Rand, 18" & 11" x 16"
1—840 CFM Laidlaw, 13" x 10"
1—1418 CFM Ingersoll-Rand 24" & 13" x 16"
1—230 CFM Gardner-Denver Model WBQ, driven by Buda 6 cylinder Gasoline engine. Skid mounted

LOCOMOTIVES
1—2-2½ ton Whitcomb Battery, 24" gauge
1—2½ ton Jeffrey battery or trolley, 36" gauge
1—3½ ton Mancha battery, 24" gauge, with 2 sets Edison batteries and charging set
1—4 ton Ironton battery, 36" gauge
2—7 ton General Electric permissable battery, 36" gauge
1—7 ton Atlas battery, 36" gauge
3—8 ton Ironton battery, 36" gauge
2—8 ton General Electric battery, 36" gauge
4—10 ton Atlas battery, 36" gauge
1—3 ton Whitcomb gas engine driven, 24" gauge
1—4½ ton Goodman trolley, 36" gauge
1—5 ton Jeffrey trolley, 36" gauge
1—6 ton Goodman trolley, 36" gauge
2—8 ton Goodman trolley, 36" gauge

TUGGERS AND SLUSHERS
1—Ingersoll Rand, model 6HC Single Drum Air Tugger
1—5 H.P. Brownie, Single Drum Electric Tugger
1—5 H.P. Sullivan Single Drum Electric Tugger
1—7½ H.P. Sullivan Double Drum Electric Slusher
2—10 H.P. Sullivan Three-Drum Electric Slushers
2—6½ H.P. Sullivan Single Drum DC Electric Tuggers
5—6½ H.P. Sullivan Double Drum DC Electric Slushers
1—10 H.P. Sullivan Two Drum driven by Continental 4 Cyl. Gas Engine.

THICKENERS & CONDITIONERS
1—24' diameter Dorr Lowhead Thickener
2—10' diameter Morse Bros. Thickeners
1—4' x 4' New Morse Conditioner

CRUSHERS
4—2-¼" x 3-½" New Morse Lab Jaw Crushers
5—4" x 6" New Morse Lab Jaw Crushers
1—9" x 15" Wheeling Jaw Crusher
1—9" x 15" Farrell Jaw Crusher
1—8" x 24" Rogers Jaw Crusher
1—8" x 36" Universal Jaw Crusher
1—11" x 18" Universal Jaw Crusher
1—24" x 13" Farrell Jaw Crusher
1—10" x 16" Hercules Jaw Crusher
1—10" x 16" Universal #3M Jaw Crusher
1—20" x 36" Austin- Western Jaw Crusher
1—36" x 48" Jeffrey Flextooth Crusher
1—26" x 18" Williams Hammermill
1—30" x 17" Williams Hammermill

VIBRATING SCREENS
1—24" x 36" New Universal Single Deck
3—3' x 5' Tyler "Hummer" Single Deck
1—42" x 72" New Universal Single Deck
1—42" x 72" New Universal Single Deck
1—42" x 72" Jeffrey-Traylor Single Deck
1—42" x 88" Jeffrey-Traylor Single Deck
1—3' x 8' Simplicity 3 deck
1—4' x 12' Symons Double Deck
1—4' x 12' Tyler "Ty-Rock" 3 Deck

FEEDERS
1—10" x 36" Jeffrey Type 2A Vibrating Feeder
1—36" x 36" Jeffrey #4 Vibrating Feeder
1—30" x 42" Type FO Vibrating Feeder Jeffrey
1—3' x 5' Hardinge Volumetric Belt Feeder
1—12" x 6' New Morse "Vari-Stroke" Ore Feeder
2—12" New Morse Wet Reagent Feeders
1—New Morse Cone Type Dry Reagent Feeder

Serving the World's Mining Regions since 1898.

MORSE BROS. MACHINERY COMPANY

2900 Brighton Blvd. **Denver 1, Colorado**

Geology of **URANIUM**

Eleven scientific papers and discussions by geologists of Atomic Energy Commission dealing with deposits of Colorado Plateau appeared in the No. 2 issue (March-April)

Jour. of Economic Geology

Price, $1.25 per copy

Order from Economic Geol. Pub. Co.

Room 105 Nat. Resources Bldg.

Urbana, Ill.

COAL PREPARATION ENGINEER

KAISER STEEL CORPORATION has opening for college graduate experienced in coal preparation or related field.

Position includes sampling, analysis and research projects at new coal preparation plant in conjunction with coal mining operation at Sunnyside, Utah.

Modern housing is available at reasonable rates. Send complete resume including salary requirements to Employment Office

KAISER STEEL CORPORATION

P.O. BOX 217,

FONTANA, CALIFORNIA

LIQUIDATION SALE

1—Hardinge Conical Ball Mill, 8' dia. x 60"
2—Jeffrey 18 x 24 Hammer Mills
2—Sweetland Filters, #10 & #5
1—Bird Contin. Centrifugal 24"
1—L-B Skip Hoist, 48 TPH
2—Shepard-Niles 4-ton Monorail Cranes with ⅜ yd. bkts.
3—Trough Belt Conveyors—45', 85', 125' L
3—Pan Conveyors—36', 85', 150' L
16—Bucket Elevators—20' to 60'

Also—Bins—Blowers—Pumps—Meters, etc.

Our Mr. Betz on premises—

Mutual Chemical Co. plant
201 West Side Ave.—Jersey City, N. J.
(Phone Henderson 3-2161)

LIQUIDATION BY

PERRY EQUIPMENT CORP.

1429 N. 6th St. Phila. 22, Pa.

MILL WANTED, FLOTATION

Have in excess hundred thousand tons stockpile, copper, gold, silver ores, composite 135 samples give 3.2% Cu, $3.85 Au, $2.15 Ag per ton, ores rejects from sorting. Substantial tonnage ready for mining, values 1.6% Cu to 18%, 0.04 to 0.46 Au. Other similar ores available. Write Box 2. Grants Pass, Oregon.

BUSINESS MEN'S CLEARING HOUSE

601 MIDLAND SAVINGS BUILDING
DENVER, COLORADO

52 years of world-wide placement service for all classes of executive, engineering, operating, etc., mine and mill men

FILE YOUR APPLICATION WITH US

MOTOR GENERATORS
All Makes—All Sizes—All Voltages
ROTARY CONVERTERS
All Makes—All Sizes—All Voltages
LOCOMOTIVES
(Trolley & Battery)
All Makes—All Sizes—All Gauges

Wallace E. Kirk Company
7025 Penn Ave. (MW) Pittsburgh 8, Penna.

LIQUIDATION!
ORE MILL EQUIPMENT
Franklin, N. J.

Partial Condensed Listings!

AIR COMPRESSORS
1—12"x12" C.P., Class NSB 292'.
1—17" & 10"x12" C.P., Class GCB, 786'
1—25"x15½"x18", 1-R-PRE-2-2056', 3 phase-440/2300 V.

CLASSIFIERS
1—90' DORR Bowl Rake Thickener.
1—24' DORR Bowl with 8'x32' rake.
3—DORR 8'x34', 3 deck, 2 section.

CONVEYORS
29—SCREW, 6" to 24" D., 10' to 139' L.
29—BUCKET ELEVATORS, Belt & Chain Types, 25' to 100' high, bucket sizes from 2"x4" to 22"x 10".
36—TROUGHING BELT, 14" to 30" wide, 22' to 264' lengths.
15—FLIGHT (SCRAPER), 24" to 36" wide, 25' to 171' lengths.
1—75', 16" Pan Conveyor.

CRANES, HOISTS & DERRICKS
1—15 ton Brown Hoist Locomotive Crane.
1—150 HP VULCAN size 72, single drum mine hoist.
15—I.R. & Sullivan 15 HP AC, 2-drum scraper hoist.
1—15 ton American Terry steel derrick, 60' mast, 55' boom.

CRUSHERS, ROLL
4—20"x15" Sturtevant.
2—32"x36" Edison.
2—36"x36" Edison.

DRYERS
1—6'4½" D. x 12' L. Link Belt, Roto Louvre Dryer, Mueller oil heater.
1—6' Oliver Drum Dryer.

ELECTRIC MOTORS
400—½ to 700 HP, including Geared head motors and motorized speed reducers to 50 HP.

FANS & BLOWERS
5—#3 Roots & Wilbraham Green.
29—American, Buffalo & Claridge, Nos. 5, 6, 17, 21, 35, 60, 80, & 100.
1—Schneible Multiple Wash Dust Collector.

FILTERS
3—13½'x8' Oliver Drum Filters.
1—6' Oliver Filter Table.

LOCOMOTIVES
2—1½ ton Atlas, 24" gauge.

MISCELLANEOUS
6—Ore Skips.
4—Man Cages.
11—Sentry Samplers.
28—Trane & Grinnell Unit Heaters.
14—Feed Rolls up to 36"x36".
1—4'x8' Trommel Screen.
1—Ross Feeder.
8—Automatic Weight Hoppers.

PUMPS
3—Wilfley, 2", 3", 4".
9—3" Morris Manganese.
27—Addt'l. Pumps, Centrifugal, Triplex, Vacuum, & Sump, up to 5650 GPM.

ROCK DRILLS
35—Gardner Denver CF-78 Drifters.
3—Gardner Denver R-91 Stopers.
4—Sullivan S-10 Stopers.

SCREENS, VIBRATING
7—4'x5' Hummer, type V16, 32, & 68.
6—Hummer, type 400, 4' x 8'.
11—Tyler Tyrock F-300, 4' x 10'.
6—4' x 10' Selecto.
3—12 KVA, 15 cycle MG Sets.

STEEL STORAGE TANKS
8—7'1" Dia. x 7'5½"
2—8' Allen Cones.
12—8' Dia. x 6'
2—11' Dia. x 20'6"
2—Cone Tanks, 16' Dia. 13'10¼" Deep.
3—14'2" Dia. x 17'
3—16' Dia. x 27'
3—28' Dia. x 30'

WIFLEY TABLES
48-5'3" x 12'10½" steel frame with #6 enclosed head motion.

Detailed Inventory mailed upon Request
Phone, Wire, Write TODAY!

L. J. LAND, INC.
Liquidators

Sales office—Franklin, N. J.
Phone Franklinborough 8-4281

New York Office — 146 Grand Street
New York 13, N. Y.

AIR COMPRESSORS—ELECTRIC
18 INGERSOLL RAND PRE-2—3864', 2060', 2200', 1568', 1302', 1092', & 676', 2300 & 440 V.

TUNNEL MUCKERS
17 EIMCO 102, 40, 21 & 12-B.

TUGGER & SLUSHER ELEC. HOISTS
22—2 & 3 DRUM, 10, 15, 25, 50 & 60 H.P.

AIR TUNNEL LOCOMOTIVES
2 MODEL 401 EIMCO NEW 1954.

2 JAW CRUSHERS
48x60 Traylor—40x42 Allis-Chalmers

8 VIBRATING SCREENS
1—3—3 DECK 4x8, 4x9 & 4x12.

FLOTATION MACHINES
20 FAGERGREN 44" & 56"—12ES KRAUT 15 H.P.

CLASSIFIERS
1—8'x31'x24' Dorr Bowl & 3—8'x34' Rake 20'x8' Dorr Hydrocomparator.
22 Dorr & Wemco 14', 16', 20', 24', 26', 36', 39' & 100' Dia., Steel & Wood Tanks.
4'6"x26'x16', & 3'x34'x12' Wemco Bowl.
3'x24'x10"x10' Dorr Turret Bowl.
40'x30'—3 Tray Dorr, 4 Compt.

SINK FLOAT MILL
Wemco Size 1 WKE (HMS) Mobile 5/25 TPH.

48 BALL, ROD & TUBE MILLS
10'x48", 8'x48", 8'x22", 6'x22", 6'x36", 5'x36", 3'x7', 4'x5', 4'x7', 4'x14', 5'x10', 5'x14', 5'x18', 6'x7', 6'x8', 6'x9', 6'x10', 7'x5', 7'x8', 7'x7', 8'x12' & 8'x8'.

DARIEN, 60 E. 42nd St., N.Y., N.Y.

FOR SALE BY OWNER

5 Flotation cell banks, Morse-Wolnig type, 33 cells, size 42" x 42" x 48" each w/5 H.P. drive,
1 Hydro separator, Western Machinery 60" x 45',
22 Pumps, slurry 3" and 4" Bingham Pump Company, rubber lined,
1 6" Denver Simplex diaphragm pump,
2 4' x 6' single deck Allis-Chalmers vibrating screens, Utah type,
2 Compressors, portable, I. R. 210 & C. P. 315,
11 Reducers, Pacific 5 H.P., G.E. motors 220-440 volts, 3 phase, 60 cycle, vertical mixing tank service 274 O.P.R.P.M.,
3 Reducers, Patterson Unipower 220-440 volt, 3 phase, 60 cycle explosion-proof motors, vertical mixing tank service (one 5 H.P., 90 O.P.R.P.M.—two 15 H.P., 37 O.P.R.P.M.),
4 Pumps, 5" Model "C" Wilfley less motors,
3 Filters, Dorrco drum type, 12' x 10' and 14' x 10',
2 Coolers, 5' x 45' Stearns Rogers.

For further information contact Mr. J. H. Clements in care of Basic Refractories, Inc., Maple Grove, Ohio.

FOR SALE

1	Herreshoff 16'—8 hearth Mercury furnace	$10,000.00
1	Allis Chalmers 6' x 15' tube mill	$ 1,500.00
10	Tons 30-35 lb. mine rail (per ton)	$ 75.00
1	Ball mill 3' x 4' O. D. (slight use)	$ 750.00
10	Tons 1¼" round lyner drill steel with attached sharp B. S. bits. Per ft.	$ 0.50
1	Dorr 12' Turret Bowl Classifier	$ 2,500.00
1	Hardinge Conical 6' Ball Mill	$ 3,000.00
1	Wilfley 14' Concentrating Table & Motor	$ 750.00
1	Productive 4 x 6 Shaking Screen & Motor	$ 700.00
1	Traylor 2½ x 6 Shaking Screen & Motor	$ 500.00

OWNER, P. O. Box 889, Reno, Nev.
(Phone Reno 3-5260)

FOR SALE
INDUSTRIAL PLANT
IN CENTRAL VALLEY, CALIFORNIA ON 76 ACRE LEASE

IDEAL LOCATION AND FACILITIES
FOR PROCESSING, CHEMICAL, OR MANUFACTURING INDUSTRY
3 MILES FROM CITY LIMITS RAILROAD SIDING WASTE DISPOSAL NATURAL GAS
ELECTRIC POWER WATER FIREPROOF BUILDING APPROX. 11,000 SQ. FT. FLOOR SPACE

Address the Taylor-Knapp Co., Successors to
TEEKAY MINES, INC., Box 245, Tracy, Calif.
OFFICE AT PLANT ON SO. JEFFERSON RD. PHONE TRACY 284
Brokers Protected

THE MARKET PLACE

NEW LIQUIDATION NOW UNDERWAY AT THE PENN MINE

Located 45 minutes from Sacramento at Campo Seco, California, on Highway 12, near Valley Springs.

1—Marcy #67 Ball Mill
1—Hardinge 6' x 16 Ball Mill
1—Amalgamation Barrel 18" x 24"
12—Buildings, all sizes
1—Dorr Classifier, rake type, 6' x 19'6"
2—Conditioners
1—G.E. 900 cfm 20 x 12 x 14 Belt-Driven by 200 HP G.E. motor
1—Worthington Laidlaw 550 cfm Belt-driven by 100 HP Westinghouse
2—16 x 60 Belt Conveyers, complete
1—16 x 25 Belt Conveyer
1—Jaw Crusher, 8 x 12 Kisdon Blake Type
2—B79 Gardner Denver Drifters, automatic
1—Bucket Elevator, 50' centers
1—Ross Chain Feeder

1—6' 4-leaf American Filter
1—2-cell Denver Sub A #18 Flotation Machine
1—3-cell Denver Sub A #18 Flotation Machine
3—4-cell Denver Sub A #18 Sp. Flotation Machines
1—6-cell Denver Sub A #18 Sp. Flotation Machine
1—100 HP Single Drum Hoist, complete
1—Yuba Placer Jig, 24" x 24"
7—1½" Sand Pumps Model K Wilfley
1—15' x 8' Thickener, steel tank
1—20' x 8' Thickener, wood tank
1—Ford Four-Wheel tractor, front end loader
1—Lot of Stainless steel valves and fittings
Thousands of feet of pipe—2", 4", 6"
Thousands of feet of Electric Cable
Plus thousands of other items . . .

Salesmen on Duty at All Times . . .

IN STOCK IN SALT LAKE CITY

1—300 KW G.M.C. 8-268A Diesel Generating Set
1—520 Skid Mounted Cat. Diesel, Gardner Denver compressor, like new.
4—50 KW U.D. 18 International Diesel—1100 hours since new.
7—Battery locomotives—2½" ton size
1—8 x 36 Hardinge Ball Mill
3—30' Thickeners
2—40' Thickeners

1—Complete Pilot Plant, including:
1—3 x 3 Ball Mill
1—24" x 12' Screw Classifier
1—6 x 9 Jaw Crusher
Feeders, etc. (Complete list on request)
5—25 HP 3-drum slushers
2—20 HP 2-drum slushers
20—Single Drum Hoists, 11 HP to 500 HP
1—600 HP single drum mine hoist, 8800 ft. rope capacity excellent

For more complete details on any mining or milling needs, write:

MACHINERY CENTER, INC.

808 Newhouse Bldg., Salt Lake City, Utah

We Cordially Invite Your Inquiry

regarding our present availability to sell your metal and mineral ore productions

COSMOPOLITAN SALES COMPANY

Selling Agents

Dept. W, 450 Seventh Ave., New York 1, N. Y.
G.P.O. Box #437, New York 1, N.Y.
BRyant 9-5681

FOR SALE: Large Williams Hammer mill and parts. Complete and ready to run. Piggott Projects, 1057 Howard Street, San Francisco, California.

DREDGE: 10" suction with cutter head. Automatic re-soiling. 100 yards per hour minimum. Terms or participating basis. A Johnston, 711 S. E. 11th, Portland, Oregon.

FOR SALE: Pan American 2-cell jig, size of cells 42" x 42"; 4' x 8' double deck Vibrating Screen; 160 cu. ft. Vacuum Pump with motor and drive; 6' x 6' Conditioner with steel tank, motor and drive; 210 cu. ft. Schramm Portable Compressor with International Diesel Engine. Address J. P. Keller, Box 6311, Phoenix, Arizona.

FOR SALE: 500 cf Gardner-Denver compressor with 13,000 Cat Diesel Mounted 6-wheel White Truck. Priced for quick sale. Box 1065, Redwood City, California.

CLASSIFIED SECTION

8 pt. type 12c per word. 10 pt. type 18c per word. Minimum charge $4.50.

(For Box numbers addressed to Mining World, add 50c)

Boxed ads (display) in either Market Place or Classified Sections—$7.50 per column inch.

(See Market Place Section for lower contract rates).

Closing Date: If proof required, 1st of preceding month, otherwise 10th.

FOR SALE

Large group of developed lead-silver mining property. Open for inspection.

119 South Knox St. Denver, Colo.

Market Place Advertising

360 inches	$5.50
180 inches	$6.00
90 inches	$6.50
45 inches	$7.00
Less than 45 inches	$7.50

Contract rates based on local number of column inches used within one year. 30 column inches equal one page.
Closing date: 1st of month preceding publication.
(Used and reconditioned equipment, liquidations, property sales only)
For additional 10,000 WORLD MINING export distribution: Add 50%

DURANGO TIN MINE: Authorized representative seeks investment capital to develop 625 acres of vein tin property in Durango. Now in production. New capital will increase output to 350 tons minimum per year. Mining reports will be sent to qualified investors. Reply to Box C-5, Mining World, 121 Second Street, San Francisco 5, California.

LEAD, SILVER, ZINC property near Bagdad, Arizona. Sale or lease. Inquire Box E-2, Mining World, 121 Second Street, San Francisco 5, California.

GOLD PLACER MINE

Two lava capped Ancient Channels in one of California's richest placer districts. Millions were taken from neighboring mines in "The Early Days." Virgin ground. Gravel samples $100 to $3,000 per yard. Complete data, reports, maps, etc., from competent engineers. Have samples $5 to $8 per gold pan and nuggets to over ½ pound. Quick operation, attractive deal. Volcano Placers, 1744 East 19th Street, Oakland 6, California.

GOLD-TITANIUM 58 acres placer near Chico, 35¢ on surface to $2.10 per ton. Also drill test on old channel shows $45.00 gold and $60.00 titanium per ton. Plenty of water. Geophysical and elevation maps. For sale or lease. Schmidt, 120 Bolt Street, Playa Del Rey, California.

URANIUM CLAIMS FOR SALE OR LEASE

Small down payment and royalty basis. Must prove up in thirty days.

We have nine (9) square miles of uranium claims, 35 miles from Las Vegas, on paved road and power. Phone: Louis Roth, 3364-R, Las Vegas, Nevada.

EXPERIENCED MINING OPERATOR, owner of Tungsten-Gold property, wishes to contact someone who can finance, through group, promotion, or otherwise, a mine operation, which will grow into a medium size project. Reply Box B-4, Mining World, 121 Second Street, San Francisco 5, California.

WANTED: Someone to test black sand, gold on large group placer claims on river. Lease and option. W. D. Bailey, Box 209, Star, Idaho.

WANTED: Assayer-chemist with several years' experience for mining company in northwest United States. Salary open. Reply Box E-6, Mining World, 121 Second Street, San Francisco, California.

INDEX OF ADVERTISERS IN MINING WORLD

Agenco Miniere & Maritime . 82
Allen-Sherman-Hoff Co. Inside Front Cover
Allis-Chalmers Mfg. Co., Gen. Machy. Div. ... WM 81 (World Mining Only)
Allis-Chalmers Mfg. Co., Tractor Div. 58, 59, 88
Allison Steel Mfg. Co. 106
Alloy Steel & Metals Co. ... 3
American Cyanamid Co. ... 17
American Manganese Steel Div. 5
American Smelting & Refining Co. 90
American Zinc Lead & Smelting Co. 92
Arizona Testing Laboratories 104
Atlas Diesel Co. ... WM 20, 21 (World Mining Only)
Atlas Powder Co. 24

Basic Refractories, Inc. 108
Bitco, Inc. 80
Black & Deason 104
Bayles Bros. Drilling Co. .. 62
Bucyrus-Erie Co. 25
Bunker Hill & Sullivan Mng. & Conc. Co. 92
Business Men's Clearing House 107

Caterpillar Tractor Co. 19-22, WM 22 (World Mining Only)
Chessher & Co. 108
Chiksan Co. 69
Christopher, Paul 106
Cleveland Div., Westinghouse Air Brake Co. 7
Coast Mfg. Co. 103
Colorado Assaying Co. 104
Colorado Fuel & Iron Corp. 12, 13
Colorado Iron Works, Sub. of Mine & Smelter Supply Co. 16
Columbian Steel Tank Co. .. 80
Consolidated Pneumatic Tool Co. ..... Inside Front Cover (World Mining Only)
Continental Drilling Co. 104
Cosmopolitan Sales Co. 109
Cowin & Co., Inc. 104
Cummins Engine Co. 32, 33

Darlon Corp. 108
Deggendorfer, T. G. 104
Deister Concentrator Co. 79
Denver Equipment Co. 14
Detectron Corp. 98
Diamond Drill Contracting Co. 106
Dickinson Laboratories 104
Dorr-Oliver, Inc. 4
Dow Chemical Co. 8

Economic Geology 107
Eimco Corp. 73, Outside Front Cover
Electric Steel Foundry Co. . 72
Engineers Syndicate, Inc. ... 105
Euclid Div., General Motors Corp. 1

Federal Pipe & Tank Co. .. 105
Fisher Research Laboratory, Inc. 103
Flexible Steel Lacing Co. .. 76

Gallagher Co. 30
Gardner-Denver Co. 2
General Electric Co., International ..... WM 12 (World Mining Only)
Geo-Engineering 104
Godoy & Co., Inc., E. A. .. 79
Goodall Brothers 104
Goodman Manufacturing Co. ..... WM 13 (World Mining Only)

Hanks, Inc., Abbot A. 104
Hardinge Co. 68
Harnischfeger Co. 96
Hawley & Hawley 104
Hawthorne, Inc., Herb J. .. 60
Hensley Equipment Co. 76

Industrial Air Products Co. . 102
International Harvester Co. . 15
International Smelting & Refining Co. 92
Isbell Construction Co. 82

Johnson, Herbert Banks 82
Jones, Philip L. 104
Joy Mfg. Co. 98, Inside Back Cover

Kaiser Steel Corp. 107
Koegel, C. P. 104
Kennametal, Inc. ..... WM 19 (World Mining Only)
Kirk Co., Wallace E. 107
Kruger Instruments, Harold . 105

Land, Inc., L. J. 108
Ladoux & Co. 104
Leschen Wire Rope Div., H. K. Porter Co., Inc. 28
LeTourneau-Westinghouse Co. 9, 11
Lundberg Explorations, Ltd. 82

Machinery Center, Inc. 109
Magma Copper Co. 92
Mayo Tunnel & Equipment Co. ..... WM 76 (World Mining Only)
McClinteck, R. S. 104
Meissner Engineers, Inc., John F. 82
Merrick Scale Mfg. Co. 103
Miller, Arnold H. 104
Mine & Smelter Supply Co. . 6
Moab Drilling Co. 104
Morse Bros. Machinery Co. . 107
Murphy, F. M. 104

Naylor Pipe Co. 89
Nordberg Mfg. Co. 64
Nuclear Instrument & Chemical Co. 94
Nucleonic Co. of America .. 91

Pacific Foundry Co., Ltd. ... 76
Pacific Machinery & Eng. Co. 106
Poole, Rodgers 104
Perry Equipment Corp. 107
Pittsburgh Lectromelt Furnace Corp. 10
Precision Radiation Instruments ..... 99, WM 82 (World Mining Only)

Resisto-Loy Co. 90
Ruderman Machinery Co. .. 106

Sauerman Bros., Inc. 79
Scandinavian Ore Tankers, Inc. 104
Shedwick, Jr., William J. .. 104
Simplex Wire & Cable Co. . 81
Smit & Co., Inc., Anton ... 102
Smith-Emery Co. 104
Smith, Paul F. 106
Standard Oil Co. of Calif. .. 23
Standard Steel Corp. 26
Stearns Roger Mfg. Co. ... 75
Stephens-Adamson Mfg. Co. ..... WM 75 (World Mining Only)
Still, Arthur E. 104
Steady Co. 70
Syntron Co. 95

Teakay Mines, Inc. 108
Thomas Flexible Coupling Co. 83
Timken Roller Bearing Co. .. 57
Traylor Eng. & Mfg. Co. .. 18

Udy, Marvin J. 104
Ultra Violet Products, Inc. . 98
Union Oil Co. 27

Van Waters & Rodgers, Inc. 104

Waite Minerals, Inc. 107
Walvoord, Inc., O. W. ... 104
Wedge Wire Corp. 82
Western Machinery Co. 74
Western Rock Bit Mfg. Co. . 77
Wild Heerbrugg Instruments, Inc. 100
Wilfley & Sons, Inc., A. R. Outside Back Cover
Wilfley, Clifford R. 104
Wilson, Glenn B. 105
Wolf, Harry J. 82
Wood Assaying Co., Henry E. 104

OPENINGS AVAILABLE AT LONG ESTABLISHED MEDITERRANEAN COPPER PROPERTY

ASSISTANT CONCENTRATOR SUPERINTENDENT

Age limit about 45. Must be graduate metallurgist having operating experience and with aptitude and experience in laboratory research and process development. Heavy sulphide ore experience desirable. Qualified to succeed to superintendency.

ASSISTANT MINE SUPERINTENDENT

For long established copper project in Mediterranean. Requires man with excellent broad mining engineering training. Some operating experience necessary. Age 30-42 must be tactful and adaptable. Forward with initial reply complete educational and experience record, list of references, age, marital status, number and age of children, photo (optional). Company offers three year contract, furnished house, transportation self and family, liberal vacations. Excellent climate, living conditions, medical and hospital facilities, school to 14 years. Non-contributory pension plan. Salary open.

ASSISTANT CHIEF ENGINEER

Age limit 45 preferably about 35. Must be graduate mechanical, chemical or civil engineer with natural mechanical ability, excellent practical and supervisory and some construction experience, for charge under Chief Engineer of all shops, foundry, mobile equipment including loading, marine, railway and construction; maintenance and repair of all types of equipment; 7250 KVA diesel generating plant.

MINE MASTER MECHANIC

Age limit 48. Should be competent supervisor with practical ability required to operate local mine shops and surface equipment and to routinely maintain surface and underground equipment. Local facilities backed up by heavy duty general shops for major repairs.

LOADING SUPERVISOR

Age limit 48 preferably about 40. Should be seasoned foreman qualified and confident in dealing with labor and willing to work irregular and extra hours during rush periods. Experienced in supervising gangs of material handlers in shipping warehouses. Some equipment handling experience desirable. All products shipped by ocean vessels.

Forward with initial reply complete educational and experience records, list of references, age, marital status, number and age of children, photo (optional). Company offers three year contract, furnished house, transportation self and family, liberal vacations. Excellent climate, living conditions, medical and hospital facilities. School to 14 years. Non-contributory pension plan. Salary open.

Reply to Box E-3, Mining World, 121 Second Street, San Francisco 5, California.

Graduate Mining Engineers with 4 or 5 years varied experience are required by large, progressive, expanding, Copper Mine in the Copperbelt of Northern Rhodesia.

Successful applicants will be given further experience in all phases of the mine technical and production departments including ventilation, draw control, survey, sampling, geology, planning and design, practical work on grizzleys, scraping, tramming, timbering and rock breaking, in order to fit them to progress to various responsible positions in the Mining Department. Basic salary will be dependent upon experience, but will not be less than £80 per month. There is in addition a variable Cost of Living Allowance at present amounting to £6.10.0d p.m., together with Pension, Life Assurance and Medical Schemes, in which the successful applicants will participate. There is also a Copper Bonus Scheme based on the prosperity of the Copper Mining Industry, which at present amounts to 60% on basic salary.

Leave would be initially at the rate of 43 days per year, and can be accumulated for three years. Single quarters only are available in the first instance, married accommodation being allocated on the basis of length of service. The waiting period for married accommodation is at present approximately one year.

Travelling expenses to Northern Rhodesia will be paid for successful applicants.

Applicants should submit details of age, qualifications, experience, marital status, availability and references to Box 562, Walter Skinner Ltd., 20 Copthall Avenue, London E.C.2. England.

WANTED: Engineer, preferably mining engineer, for technical service. Work involves development, manufacture, sales, and use of commercial explosives. Location southwest. Recent graduate or man with limited experience preferred. Submit resume to General Superintendent, Apache Powder Company, Benson, Arizona.

POSITION AVAILABLE: Graduate engineer to manage mining property producing two hundred tons per day, located in the Andes of Southern Peru. Must speak Spanish, preferably Latin American operating experience. Send professional record and salary desired to Box E-5, Mining World, 121 Second Street, San Francisco 5, Calif.

PROCESS METALLURGIST

Process Metallurgist under 40 with 5 to 10 years experience in ore flotation field. For responsible position in separation and concentration of ores. Southeast U. S. Your reply will be held confidential. Include age, education, experience, and salary requirements. Reply Box E-1, Mining World, 121 Second Street, San Francisco 5, California.

POSITION AVAILABLE: Graduate engineer thoroughly experienced open-cut mining preferably with Latin-American operating background needed for preparation estimates later operation location South America, salary open. Send full professional record, salary desired, references. Reply Box E-4, Mining World, 121 Second Street, San Francisco 5, California.

It's a Fact!

JOY AXIVANE® MINE BLOWERS

produce more air per horsepower

You don't have to make complicated tests to check the efficiency of Joy blowers. Just compare the performance data we can quickly make available to you with the published performance data of conventional mine blowers. That will give you positive proof that the mechanical efficiency of Joy blowers is unexcelled for high or low pressure operations.

Moreover, the pressure range in which AXIVANE blowers operate with unequalled efficiency is so wide that it is totally unnecessary to have one type of blower for short lengths of tubing and another type for longer lengths. The Joy AXIVANE mine blower will operate through any length of tubing with high efficiency.

Built in two sizes (3 and 5 H.P.) to handle most blowing jobs. For greater duties, AXIVANE fans from 5 to 3000 H.P. are available. ● Write for data—let us work with you.

AERODYNAMIC DESIGN

The blades of Joy blowers are of airfoil shape, similar in cross-section to an airplane wing. Rotors are of cast-aluminum construction, permitting accurate adherence to the design shape. Both the number and shape of the blades and stationary vanes are mathematically determined to insure greatest efficiency. The minute clearance between blade-tip and blower casing eliminates most tip loss, a common cause of fan inefficiency and noisy operation.

VANEAXIAL CONSTRUCTION

Joy blowers have stationary vanes to recover the rotative energy imparted to the air by the rotor. The airflow from AXIVANE blowers is therefore substantially axial. The unequalized outlet pressures of all other fan types create non-axial, turbulent airflow, which is wasteful of power. Joy blowers consequently give you a more favorable electric-to-air-power ratio, and are relatively quiet in operation.

Write for Bulletin J-607, or . . .

Consult a Joy Engineer

JOY MANUFACTURING COMPANY
Oliver Building Pittsburgh 22, Pa.
In Canada: Joy Manufacturing Co. (Canada) Ltd., Galt, Ontario

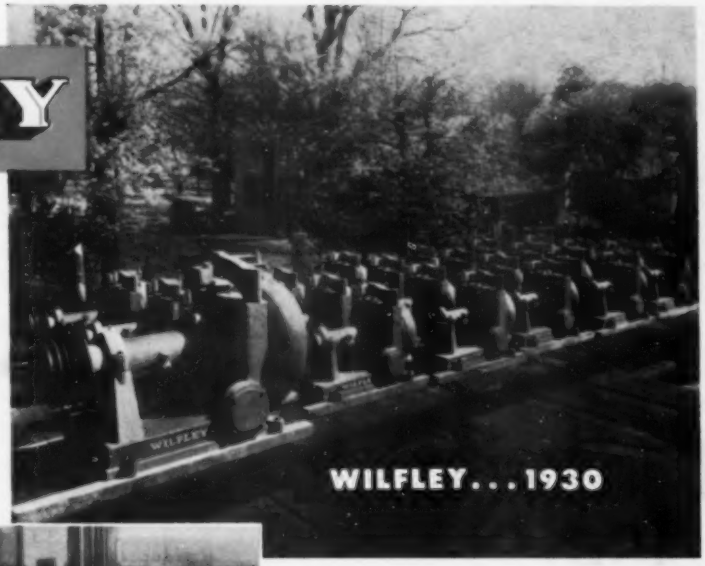
W&D M 37528

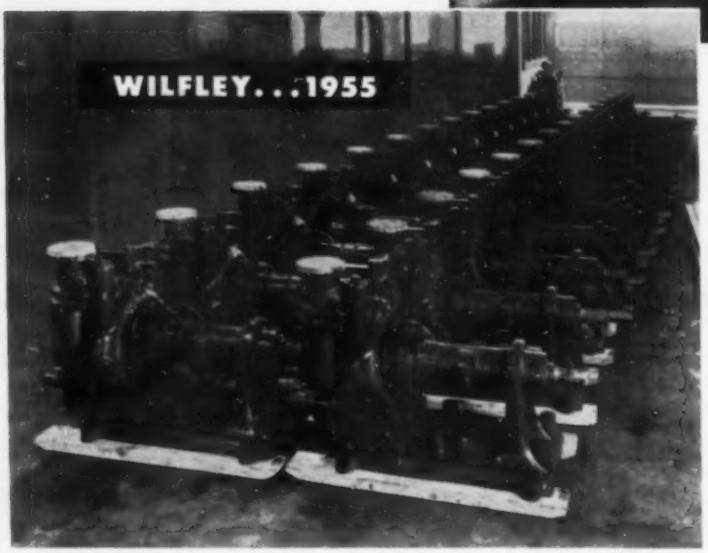
JOY

WORLD'S LARGEST MANUFACTURER OF UNDERGROUND MINING EQUIPMENT

WILFLEY

...Advances with the Mineral Industry





Progress in Low-Cost Pumping

Top photo (right) shows part of a large shipment of Wilfley Model "C" Sand Pumps ready for delivery to a large nickel producer.

25 years later this same company still depends on Wilfley for low-cost pumping. Shown in bottom photo is part of a large shipment of Wilfley's new Model "K" pumps on their way to the same customer.

The name Wilfley means continued progress in efficient, economical pumping. Wilfley keeps pace with mineral production throughout the world by designing and manufacturing pumps that definitely deliver cost-saving performance on every application.

Write or wire for complete details on Wilfley Pumps

Wilfley Acid Pump
COMPANIONS IN ECONOMICAL OPERATION
Wilfley Sand Pump

A. R. WILFLEY and SONS, INC. Denver, Colorado, U. S. A.